US008850525B1

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Wilkinson et al.

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(45) **Date of Patent: Sep. 30, 2014**

(54) **ACCESS CONTROL CENTER AUTO CONFIGURATION**

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(73) Assignee: **United Services Automobile Association (USAA)**, San Antonio, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 842 days.

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(22) Filed: **Sep. 17, 2008**

(51) **Int. Cl.**

H04L 9/32	(2006.01)
G06F 9/48	(2006.01)
G06F 9/44	(2006.01)

(52) **U.S. Cl.**
CPC ***G06F 9/4445*** (2013.01); ***G06F 9/4875*** (2013.01)
USPC **726/4**; 726/6; 718/1; 709/203

(58) **Field of Classification Search**
CPC G06F 9/4445; G06F 9/4862; G06F 9/4875
USPC 726/4; 705/26.41; 718/1; 709/203
See application file for complete search history.

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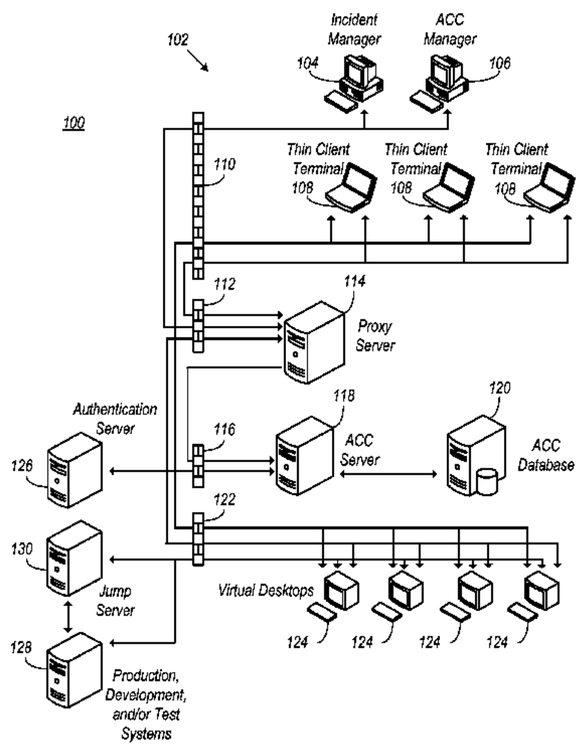
Primary Examiner — Jung Kim
Assistant Examiner — Thomas Ho
(74) *Attorney, Agent, or Firm* — Eric Sophir; Dentons US LLP

(57) **ABSTRACT**

Methods and systems provide indirect and temporary access to a company's IT infrastructure and business applications. The methods/systems involve establishing an access control center (ACC) to control the access that technical support personnel may have to the company's IT infrastructure and business applications. Thin client terminals with limited functionality may then be set up in the ACC for use by the technical support personnel. The thin client terminals connect the technical support personnel to workstations outside the ACC that operate as virtual desktops. The virtual desktops in turn connect the technical support personnel to the IT infrastructure and business applications. An ACC application may be used to automatically establish the connection between the thin client terminals to the virtual desktops, and the virtual desktops to the IT infrastructure and business applications. The ACC application may include an auto configuration module for automatically configuring a root privilege manager and jump server.

21 Claims, 18 Drawing Sheets



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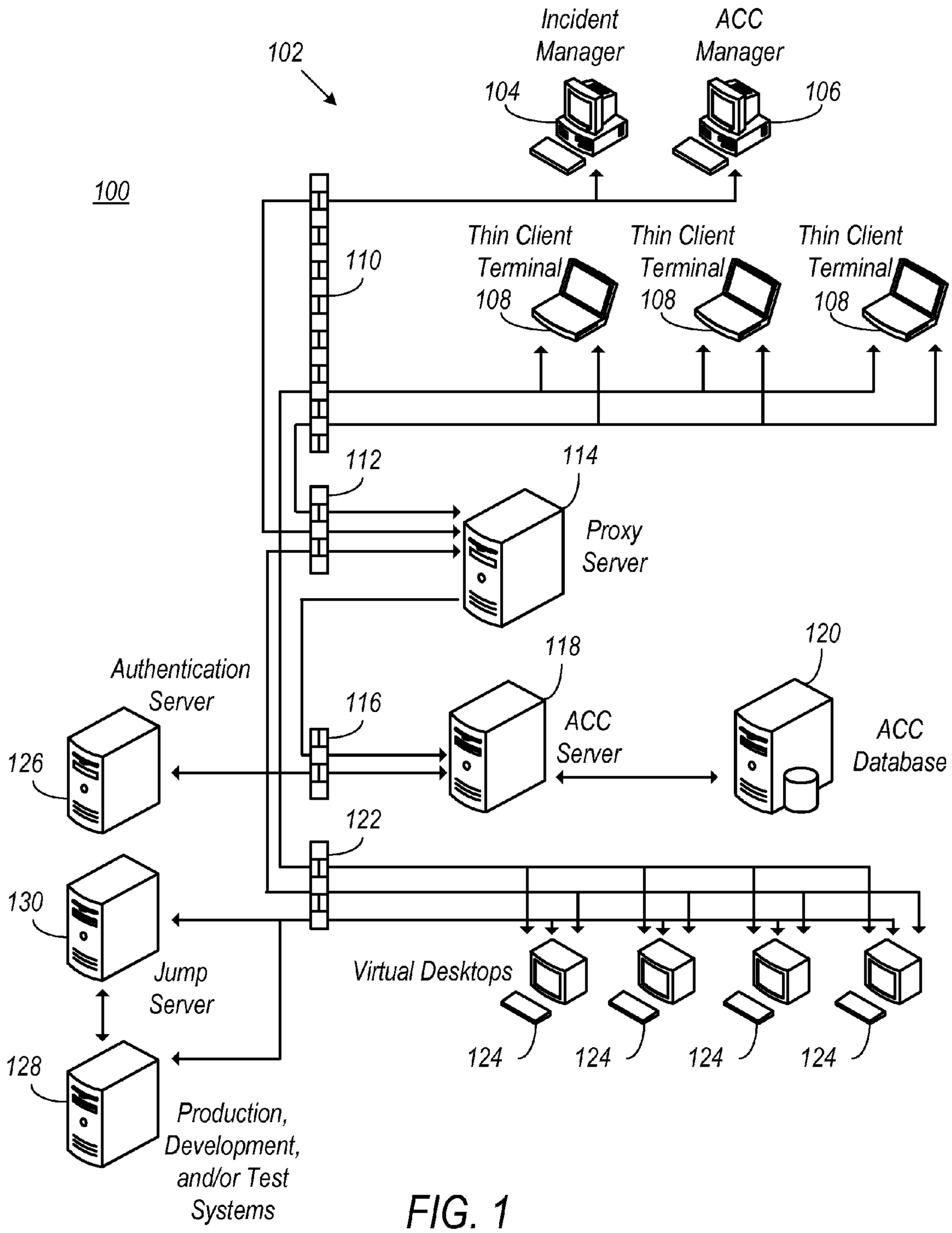
100
102
Incident Manager
104
ACC Manager
106
110
Thin Client Terminal
108
Thin Client Terminal
108
Thin Client Terminal
108
112
114
Proxy Server
Authentication Server
126
116
118
ACC Server
120
ACC Database
122
130
Jump Server
128
Production, Development, and/or Test Systems
Virtual Desktops
124
124
124
124

FIG. 1

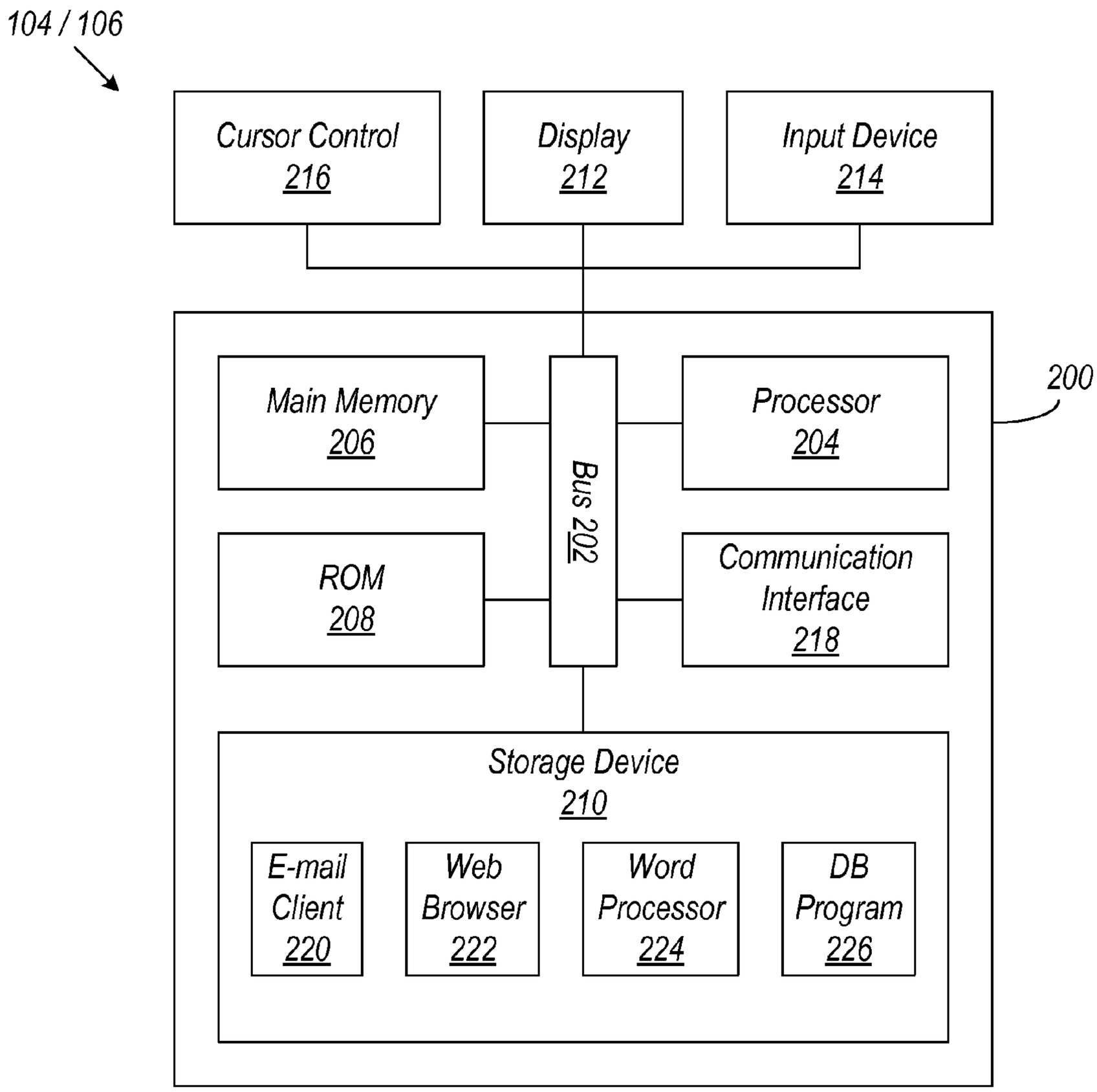
104 / 106
Cursor Control
216
Display
212
Input Device
214
200
Main Memory
206
Bus 202
Processor
204
ROM
208
Communication
Interface
218
Storage Device
210
E-mail
Client
220
Web
Browser
222
Word
Processor
224
DB
Program
226
Incident/ACC Manager Terminal

FIG. 2

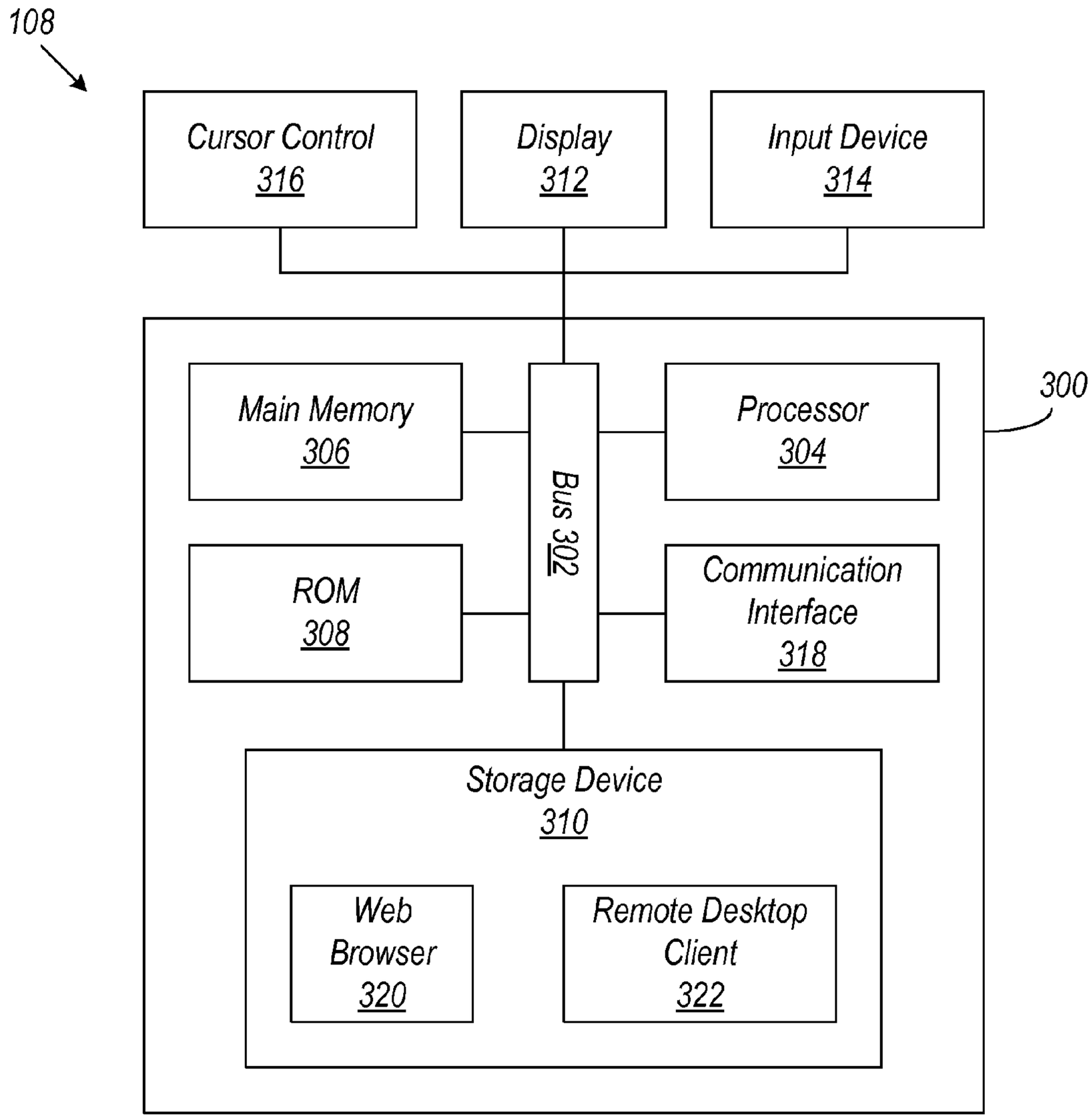
108
Cursor Control
316
Display
312
Input Device
314
300
Main Memory
306
Bus 302
Processor
304
ROM
308
Communication
Interface
318
Storage Device
310
Web
Browser
320
Remote Desktop
Client
322
Thin Client Terminal

FIG. 3

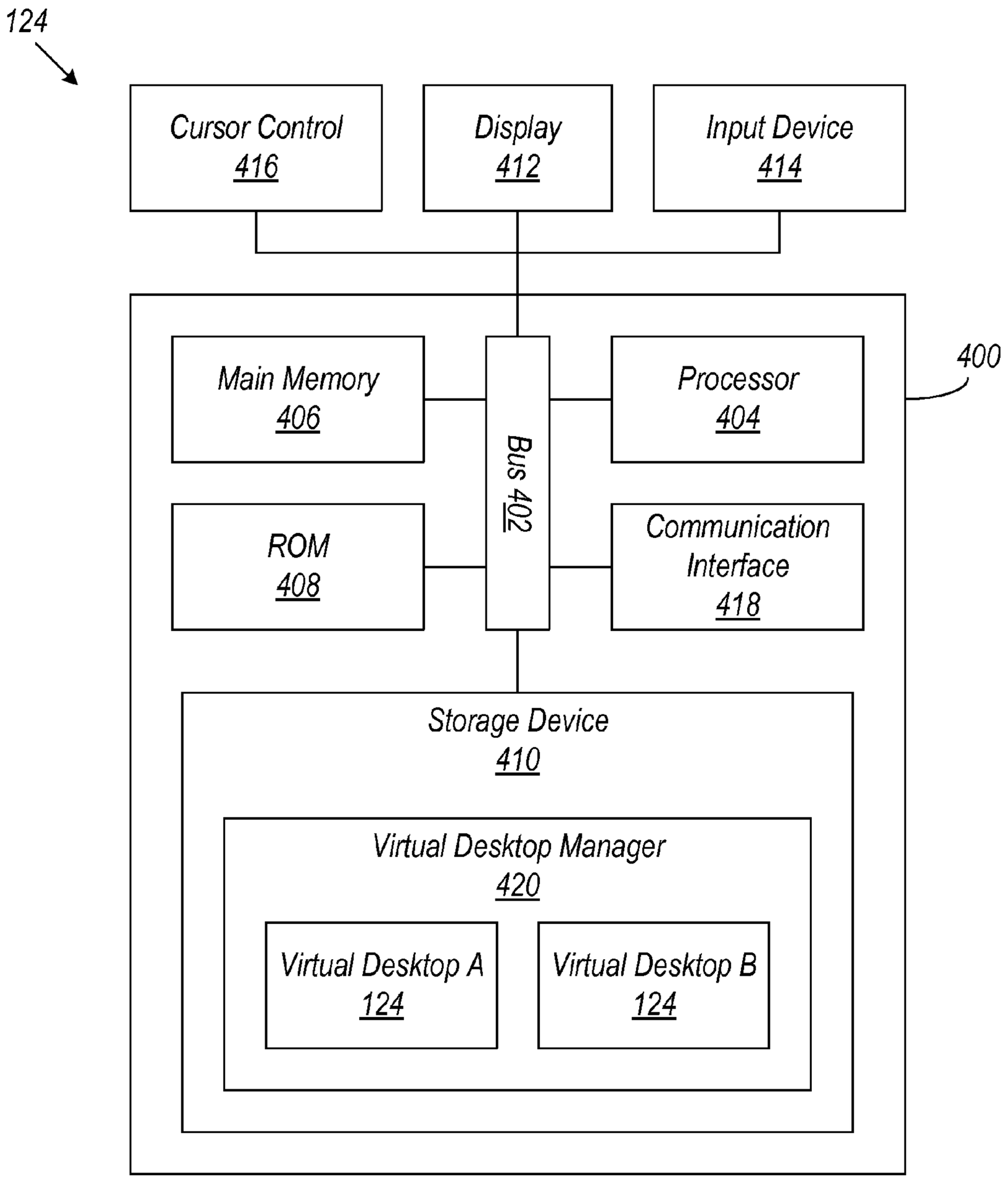
124
Cursor Control
416
Display
412
Input Device
414
400
Main Memory
406
Bus 402
Processor
404
ROM
408
Communication Interface
418
Storage Device
410
Virtual Desktop Manager
420
Virtual Desktop A
124
Virtual Desktop B
124
Workstation

FIG. 4

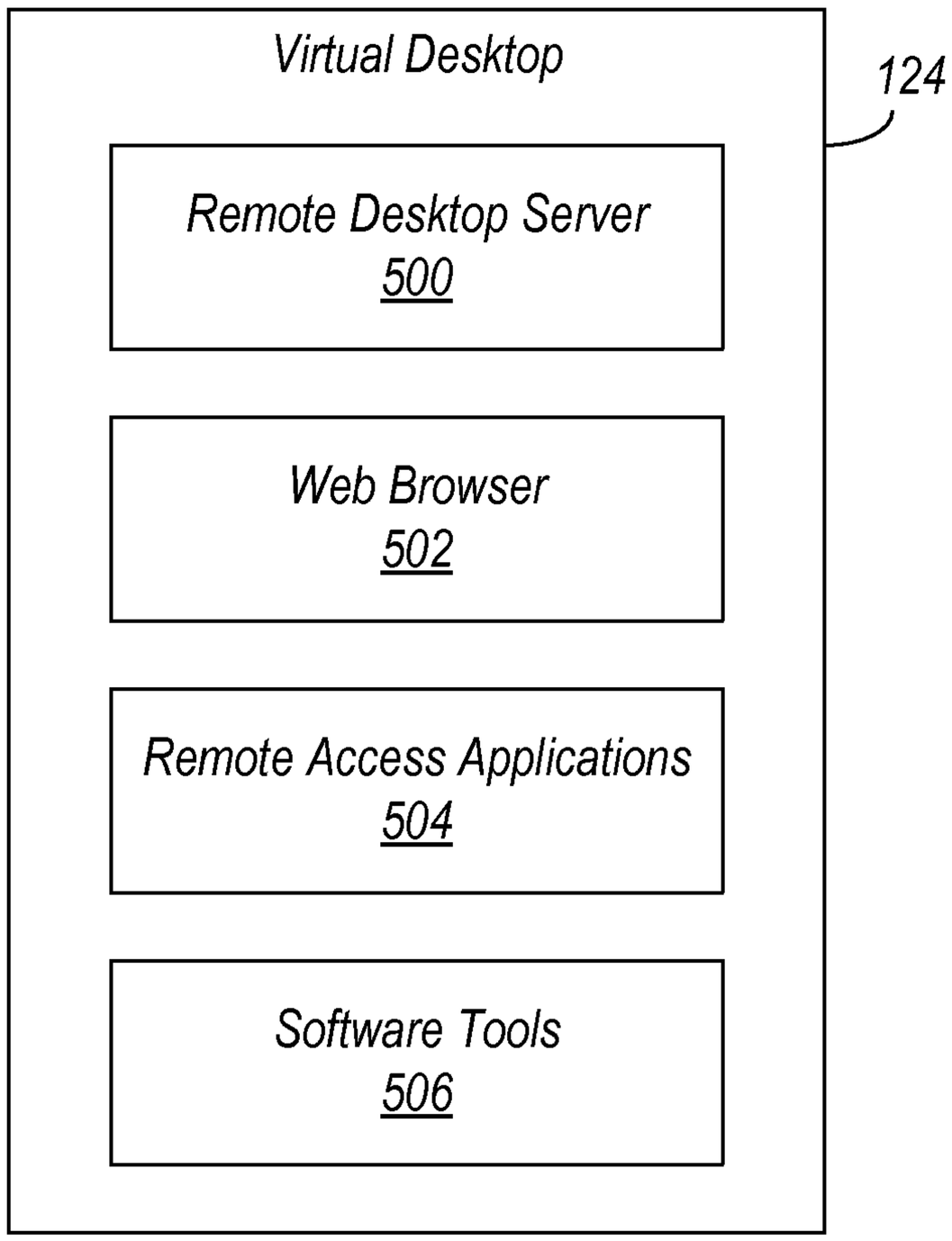
Virtual Desktop
124
Remote Desktop Server
500
Web Browser
502
Remote Access Applications
504
Software Tools
506

FIG. 5

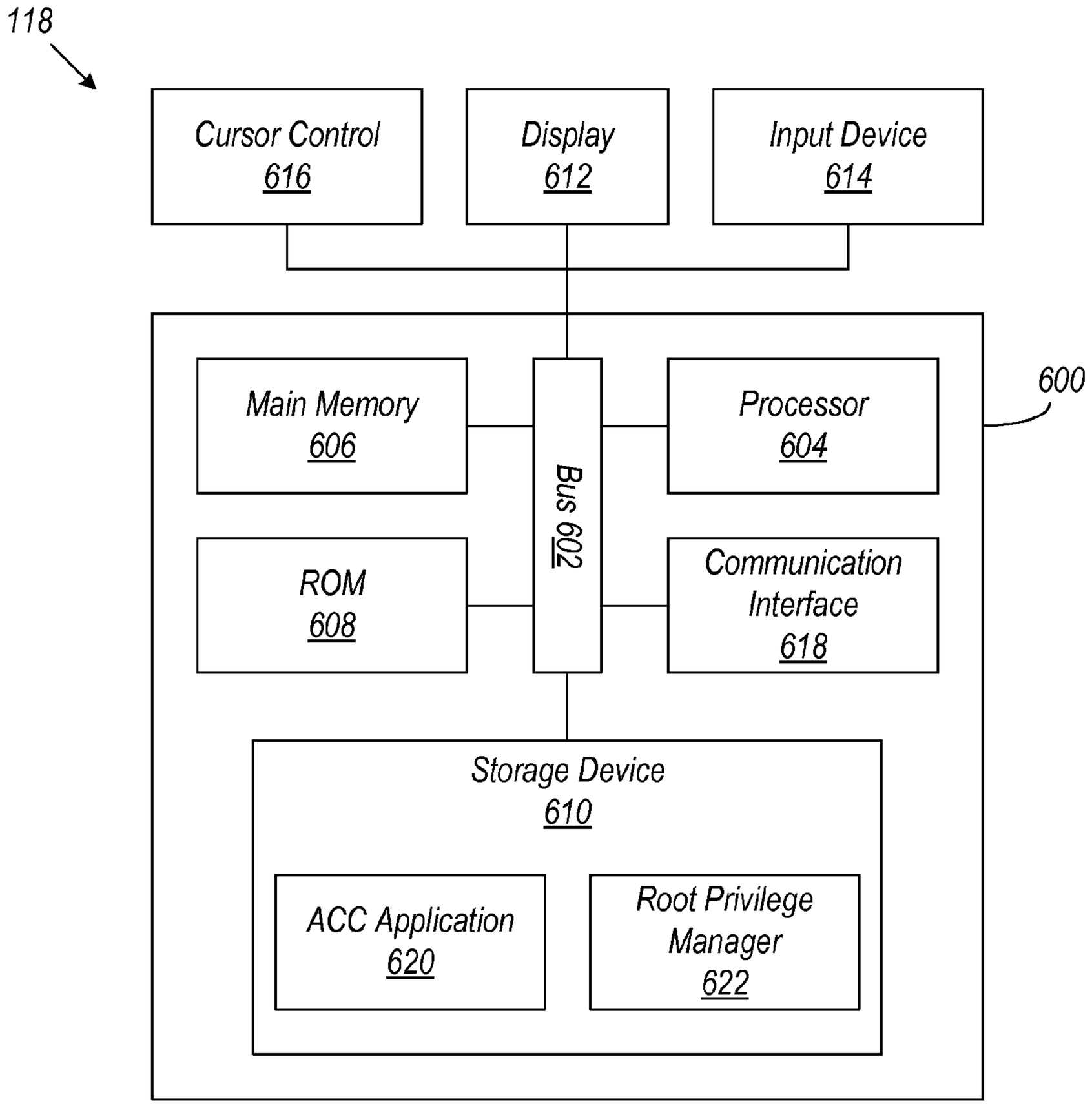
118
Cursor Control
616
Display
612
Input Device
614
600
Main Memory
606
Bus 602
Processor
604
ROM
608
Communication Interface
618
Storage Device
610
ACC Application
620
Root Privilege Manager
622
ACC Server

FIG. 6

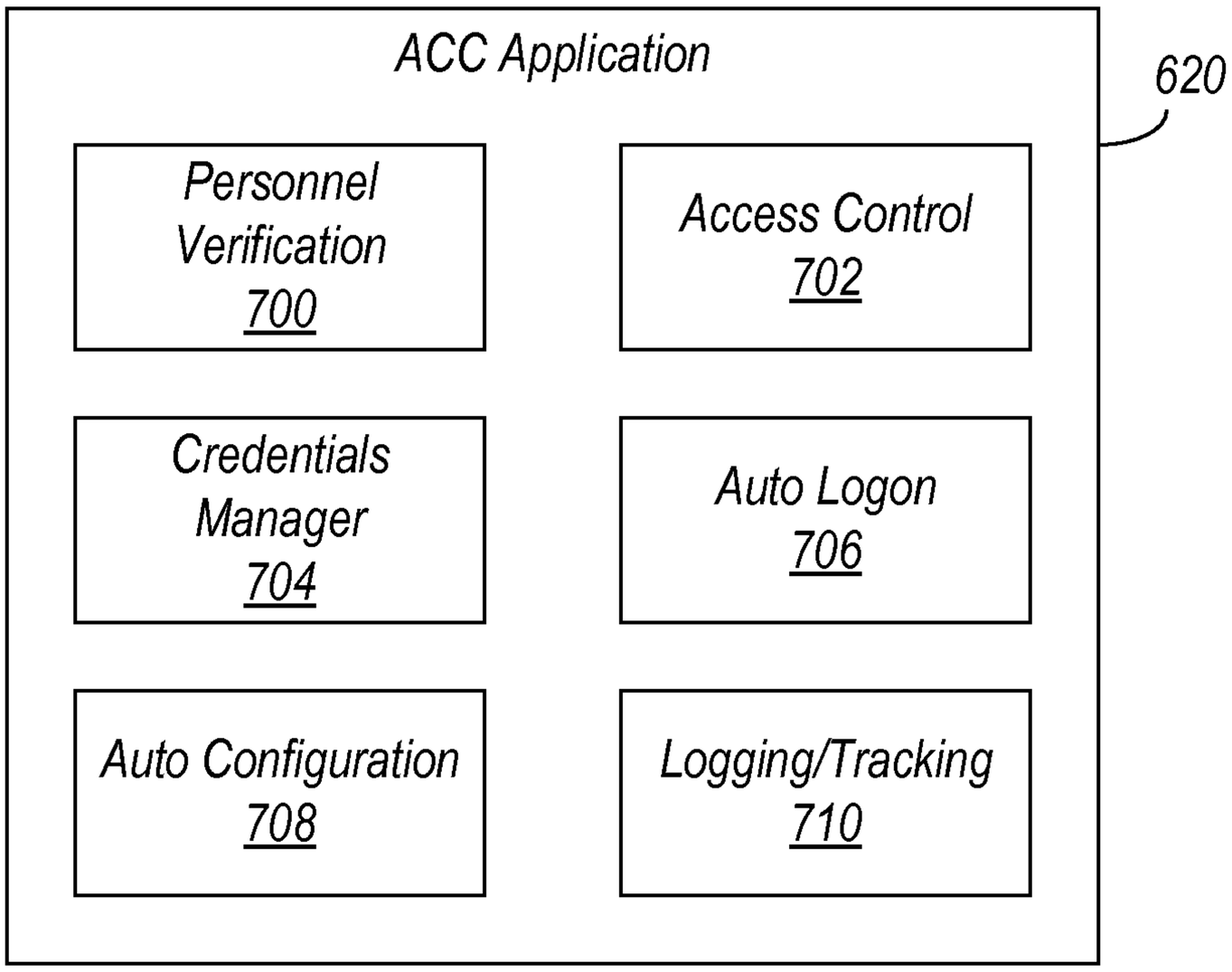
ACC Application
620
Personnel Verification 700
Access Control 702
Credentials Manager 704
Auto Logon 706
Auto Configuration 708
Logging/Tracking 710

FIG. 7

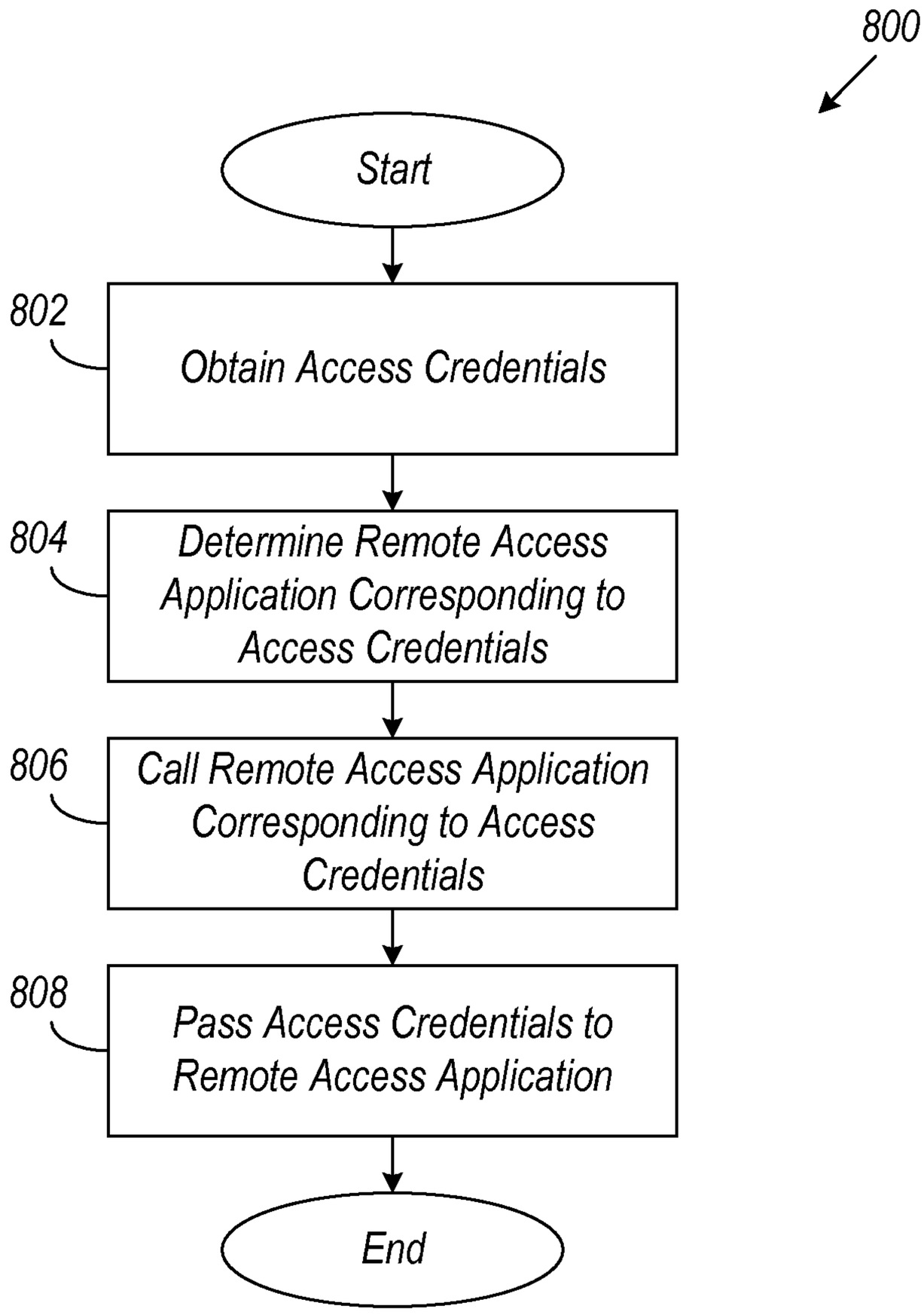
800
Start
802
Obtain Access Credentials
804
Determine Remote Access Application Corresponding to Access Credentials
806
Call Remote Access Application Corresponding to Access Credentials
808
Pass Access Credentials to Remote Access Application
End

FIG. 8

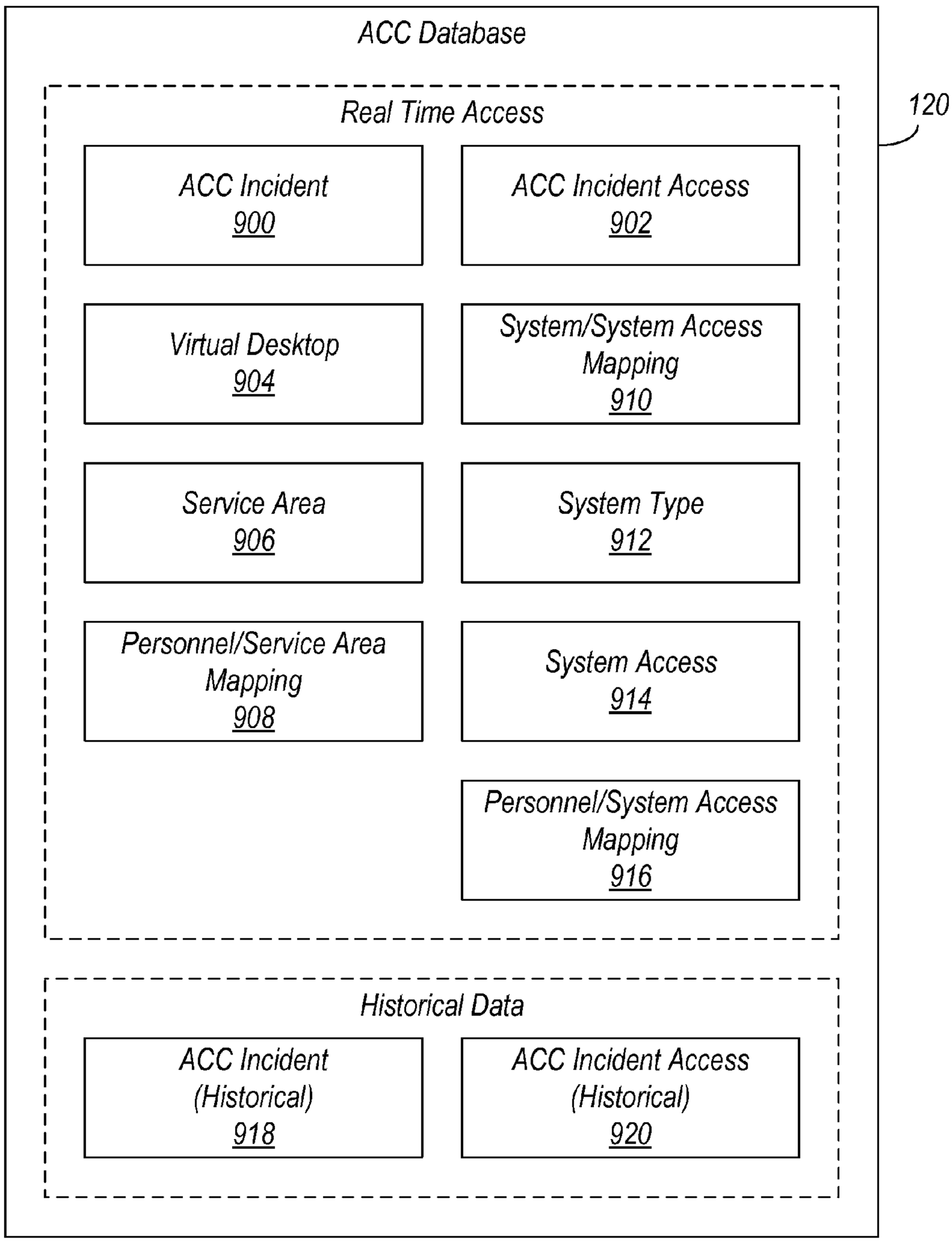
ACC Database
120
Real Time Access
ACC Incident
900
ACC Incident Access
902
Virtual Desktop
904
System/System Access
Mapping
910
Service Area
906
System Type
912
Personnel/Service Area
Mapping
908
System Access
914
Personnel/System Access
Mapping
916
Historical Data
ACC Incident
(Historical)
918
ACC Incident Access
(Historical)
920

FIG. 9

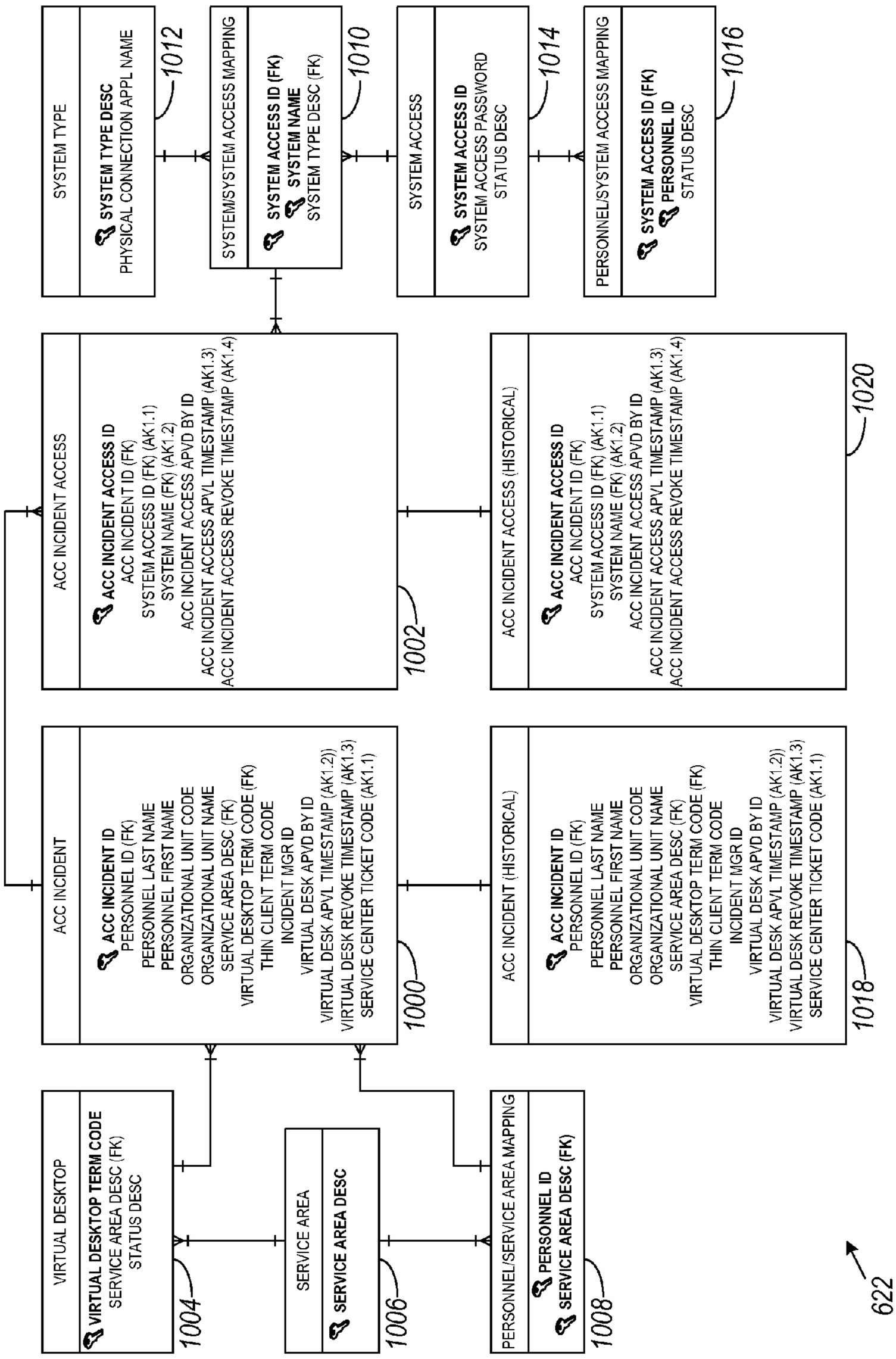
SYSTEM TYPE
SYSTEM TYPE DESC
PHYSICAL CONNECTION APPL NAME
1012
SYSTEM/SYSTEM ACCESS MAPPING
SYSTEM ACCESS ID (FK)
SYSTEM NAME
SYSTEM TYPE DESC (FK)
1010
SYSTEM ACCESS
SYSTEM ACCESS ID
SYSTEM ACCESS PASSWORD
STATUS DESC
1014
PERSONNEL/SYSTEM ACCESS MAPPING
SYSTEM ACCESS ID (FK)
PERSONNEL ID
STATUS DESC
1016
ACC INCIDENT ACCESS
ACC INCIDENT ACCESS ID
ACC INCIDENT ID (FK)
SYSTEM ACCESS ID (FK) (AK1.1)
SYSTEM NAME (FK) (AK1.2)
ACC INCIDENT ACCESS APVD BY ID
ACC INCIDENT ACCESS APVL TIMESTAMP (AK1.3)
ACC INCIDENT ACCESS REVOKE TIMESTAMP (AK1.4)
1002
ACC INCIDENT ACCESS (HISTORICAL)
ACC INCIDENT ACCESS ID
ACC INCIDENT ID (FK)
SYSTEM ACCESS ID (FK) (AK1.1)
SYSTEM NAME (FK) (AK1.2)
ACC INCIDENT ACCESS APVD BY ID
ACC INCIDENT ACCESS APVL TIMESTAMP (AK1.3)
ACC INCIDENT ACCESS REVOKE TIMESTAMP (AK1.4)
1020
ACC INCIDENT
ACC INCIDENT ID
PERSONNEL ID (FK)
PERSONNEL LAST NAME
PERSONNEL FIRST NAME
ORGANIZATIONAL UNIT CODE
ORGANIZATIONAL UNIT NAME
SERVICE AREA DESC (FK)
VIRTUAL DESKTOP TERM CODE (FK)
THIN CLIENT TERM CODE
INCIDENT MGR ID
VIRTUAL DESK APVD BY ID
VIRTUAL DESK APVL TIMESTAMP (AK1.2))
VIRTUAL DESK REVOKE TIMESTAMP (AK1.3)
SERVICE CENTER TICKET CODE (AK1.1)
1000
ACC INCIDENT (HISTORICAL)
ACC INCIDENT ID
PERSONNEL ID (FK)
PERSONNEL LAST NAME
PERSONNEL FIRST NAME
ORGANIZATIONAL UNIT CODE
ORGANIZATIONAL UNIT NAME
SERVICE AREA DESC (FK)
VIRTUAL DESKTOP TERM CODE (FK)
THIN CLIENT TERM CODE
INCIDENT MGR ID
VIRTUAL DESK APVD BY ID
VIRTUAL DESK APVL TIMESTAMP (AK1.2))
VIRTUAL DESK REVOKE TIMESTAMP (AK1.3)
SERVICE CENTER TICKET CODE (AK1.1)
1018
VIRTUAL DESKTOP
VIRTUAL DESKTOP TERM CODE
SERVICE AREA DESC (FK)
STATUS DESC
1004
SERVICE AREA
SERVICE AREA DESC
1006
PERSONNEL/SERVICE AREA MAPPING
PERSONNEL ID
SERVICE AREA DESC (FK)
1008
622

FIG. 10

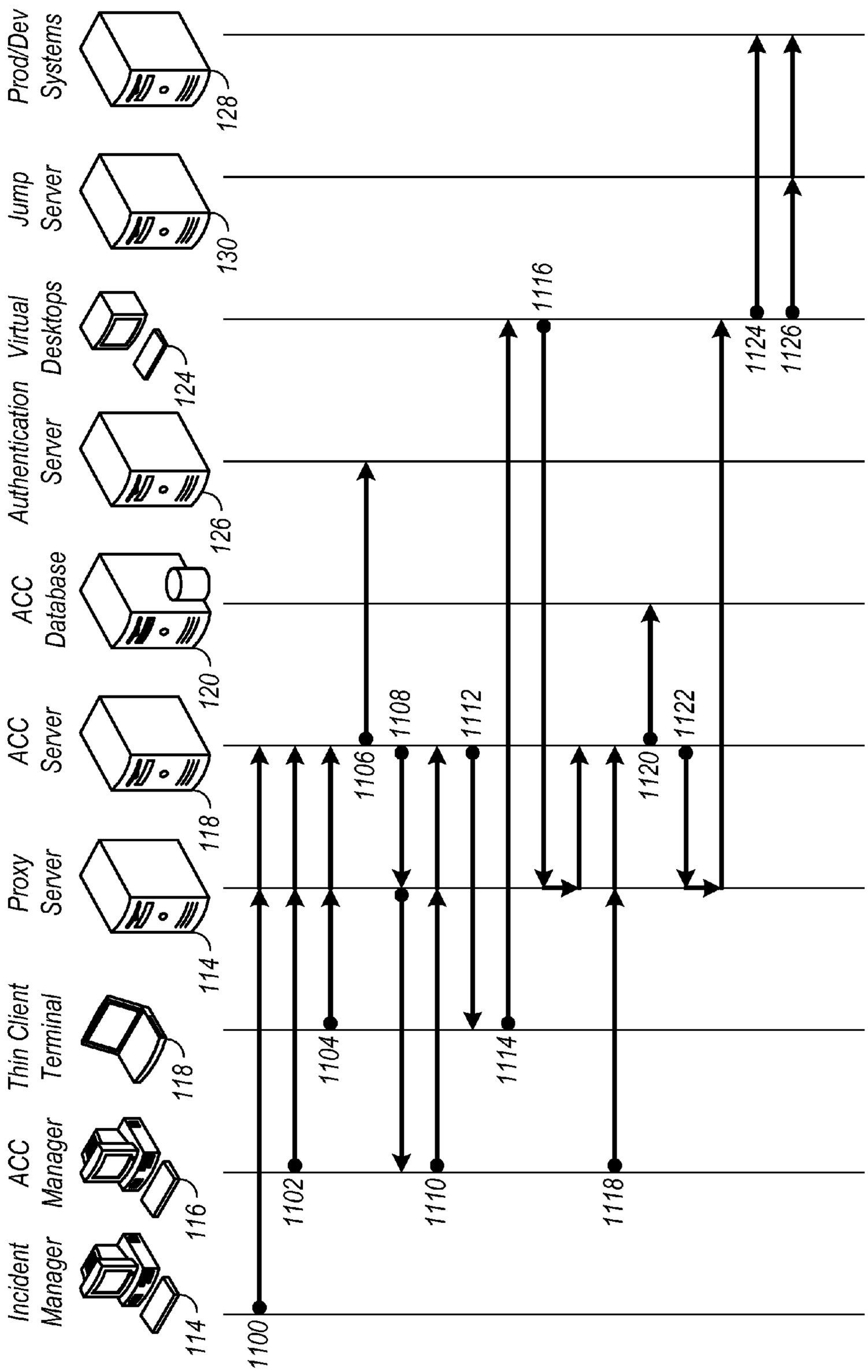
Prod/Dev Systems
128
Jump Server
130
Virtual Desktops
124
Authentication Server
126
ACC Database
120
ACC Server
118
Proxy Server
114
Thin Client Terminal
118
ACC Manager
116
Incident Manager
114
1100
1102
1104
1106
1108
1110
1112
1114
1116
1118
1120
1122
1124
1126

FIG. 11

1200

Report Your Ticket Number		
Ticket Number:		
Enter Employee(s) Identification		
Add Another Row	Employee ID(s):	
	Employee ID(s):	
	Employee ID(s):	
	Employee ID(s):	
	Employee ID(s):	
	Employee ID(s):	
	Employee ID(s):	

Clear Submit

FIG. 12

1300

1304 1302

Virtual Desktop Requests

Service Area	Service Area	EMP ID	Name	Unit	Assigned By	TC Lterm	VD Lterm	Approve
Windows	P1233333	GH45686	Oncall, Tony	012535 - Windows Server Mgt	BB25555	L6002122	-Select-	O Yes O No
Host	P4444444	JK67654	Oncall, Chris	012535 - Windows Server Mgt	BB45555	L6001222	-Select-	O Yes O No
Host	P5555555	LM38456	Oncall, Jeremy	012535 - Windows Server Mgt	BB55555	L6012222	-Select-	O Yes O No

Destination Requests

Service Area	Ticket	EMP ID	Name	Destination	Prod ID	Approve
Windows	P1111111	ABB2832	Oncall, Joe	Prodloadrun1w	-Select-	O Yes O No
Windows	P2222222	CD23456	Oncall, Steve	Prodloadrun1w	-Select-	O Yes O No
Windows	P2222222	CD23456	Oncall, Steve	Prodloadrun2w	-Select-	O Yes O No
Host	P2222222	CD23456	Oncall, Steve	System9	-Select-	O Yes O No

Clear Submit

FIG. 13

1400

1402

1404

Active Sessions

Service Area	Ticket	EMP ID	Name	Unit	Assigned By	TC Lterm	VD Lterm	Approved By	Datetime	Revoke VD
Windows	P1111111	AB82832	Oncall, Joe	0125235-Windows Server Mgt	BB55555	L6002222	L6003333	CC33492		☐
Windows	P2222222	CD23456	Oncall, Steve	0125235-Windows Server Mgt	BB66666	L6002221	L6004444	DD33944		☐
Windows	P2222222	CD23456	Oncall, Steve	0125235-Windows Server Mgt	BB66666	L6002221	L6004444	DD33944		
Windows	P2222222	CD23456	Oncall, Steve	0125235-Windows Server Mgt	BB66666	L6002221	L6004444	DD33944		
Host	P3333333	EF23345	Oncall, James	0125235-Windows Server Mgt	BB45555	L6002212	L6005555	GG22342		☐
Windows	P3333333	GH45686	Oncall, Tony	0125235-Windows Server Mgt	BB25555	L6002122	L6006666	HH33469		
Host	P4444444	JK87654	Oncall, Chris	0125235-Windows Server Mgt	BB55555	L6001222	L6003333	UU20094		☐
Host	P5555555	LM38456	Oncall, Jeremy	0125235-Windows Server Mgt	BB95555	L6012222	L6004444	JJ67784		☐

Destination	Prod ID	Approved By	Dest Datetime	Revoke Dest
Prodloadrun1w		BB82822		☐
Prodloadrun2w		BB72822		☐
Prodloadrun3w		BB62822		☐

Refresh Submit

FIG. 14

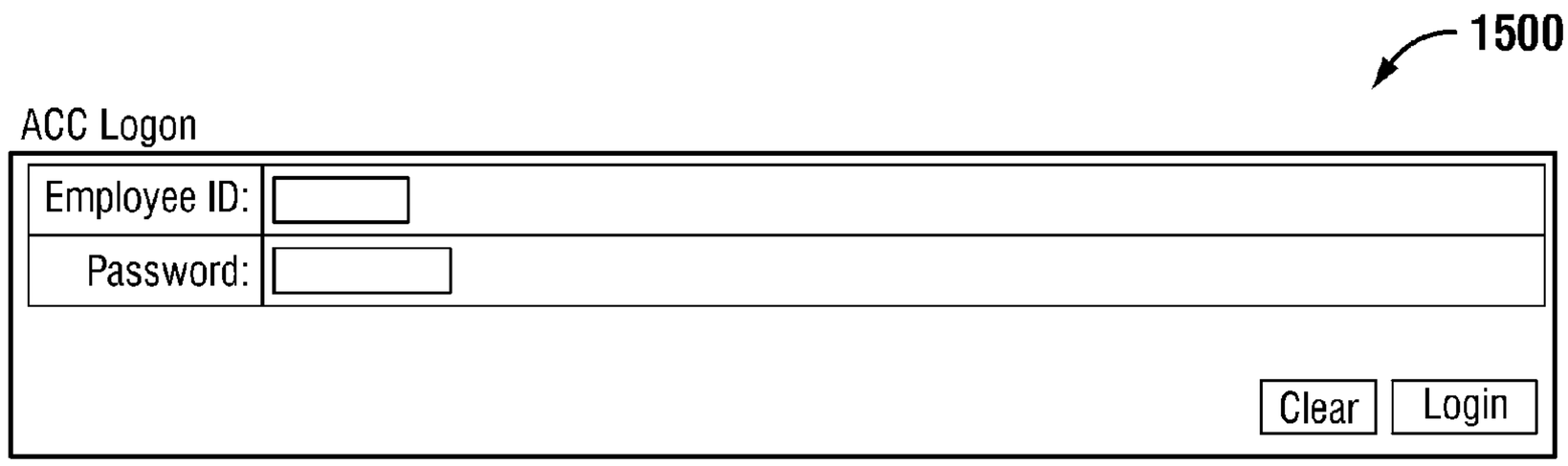
1500
ACC Logon
Employee ID:
Password:
Clear
Login

FIG. 15

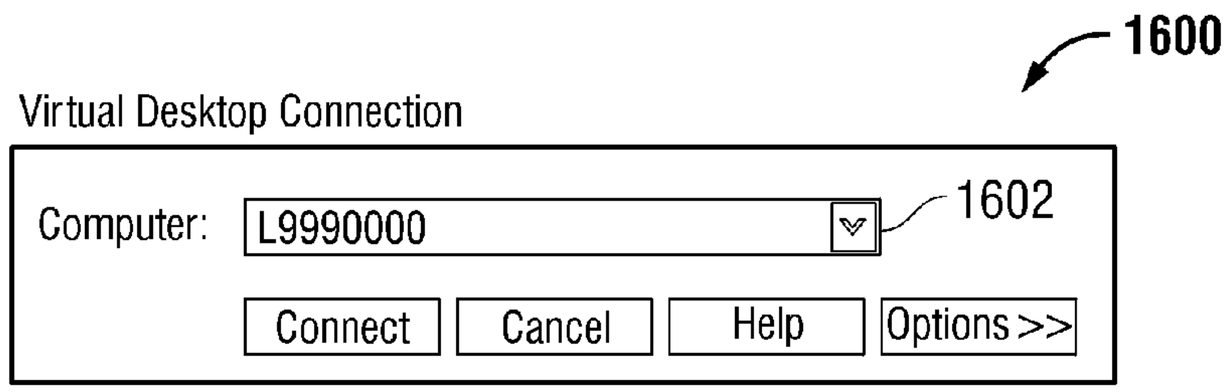
1600
Virtual Desktop Connection
Computer:
L9990000
1602
Connect
Cancel
Help
Options >>

FIG. 16

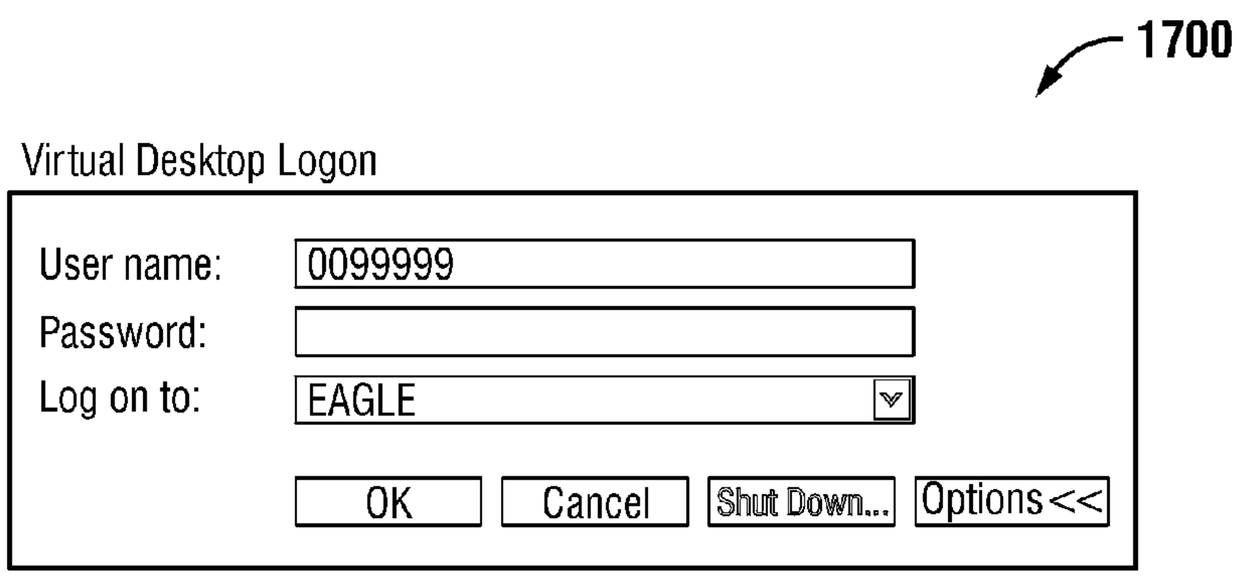
1700
Virtual Desktop Logon
User name:
0099999
Password:
Log on to:
EAGLE
OK
Cancel
Shut Down...
Options <<

FIG. 17

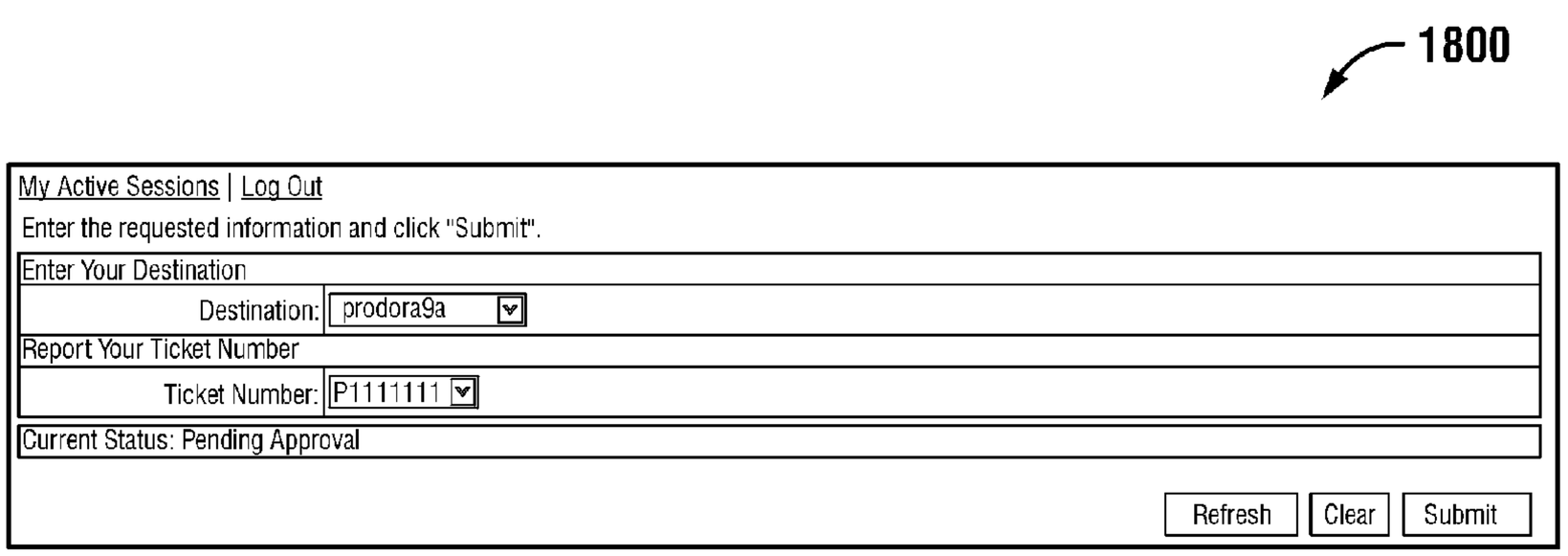
1800
My Active Sessions | Log Out
Enter the requested information and click "Submit".
Enter Your Destination
Destination:
prodora9a
Report Your Ticket Number
Ticket Number:
P1111111
Current Status: Pending Approval
Refresh
Clear
Submit

FIG. 18

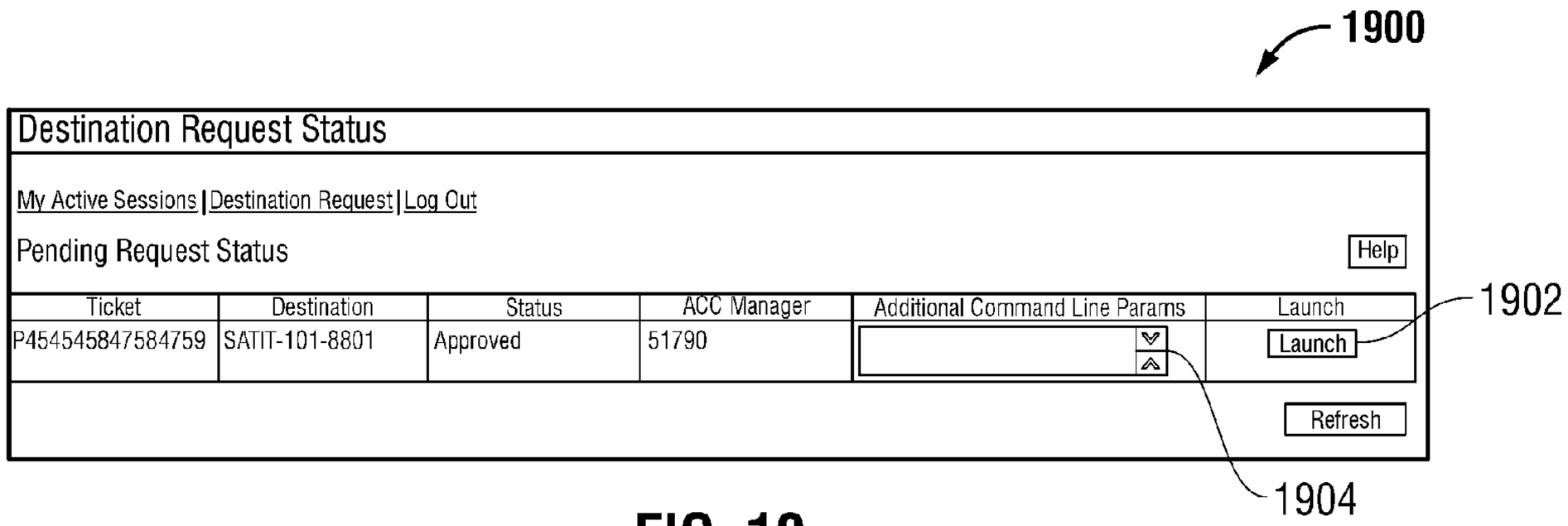
1900
Destination Request Status
My Active Sessions | Destination Request | Log Out
Pending Request Status
Help
Ticket
Destination
Status
ACC Manager
Additional Command Line Params
Launch
P455455847584759
SATIT-101-8801
Approved
51790
Launch
Refresh
1902
1904

FIG. 19

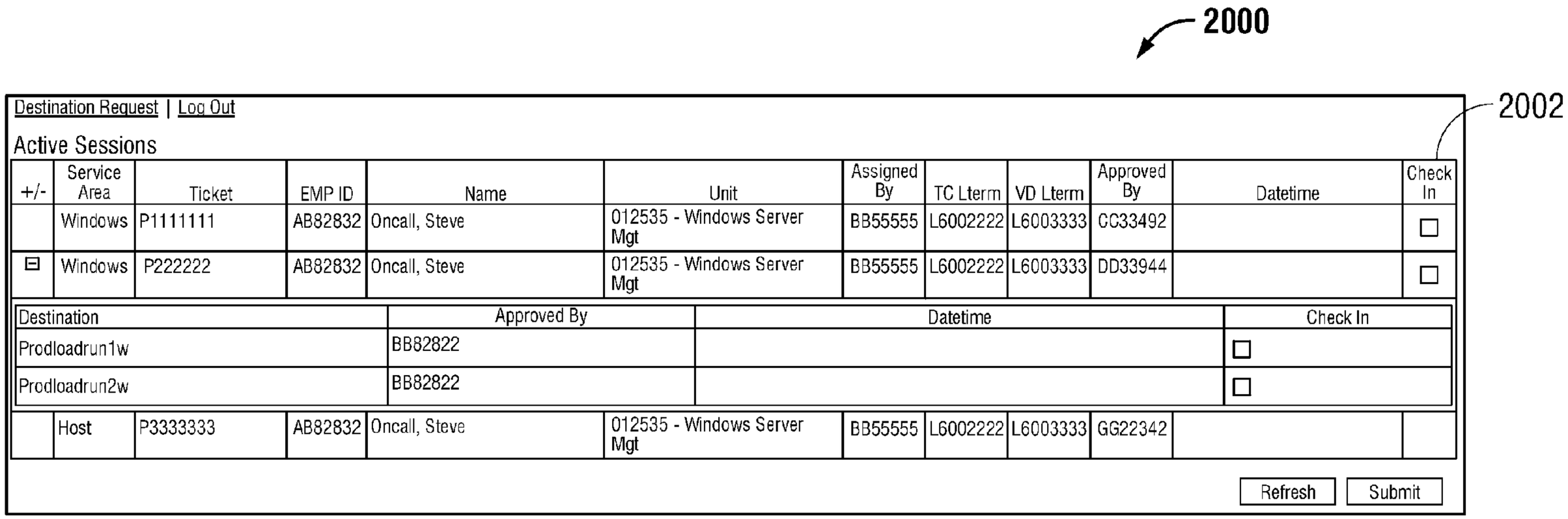
2000
Destination Request | Log Out
Active Sessions
+/-
Service Area
Ticket
EMP ID
Name
Unit
Assigned By
TC Lterm
VD Lterm
Approved By
Datetime
Check In
Windows
P1111111
AB82832
Oncall, Steve
012535 - Windows Server Mgt
BB55555
L6002222
L6003333
CC33492
Windows
P222222
AB82832
Oncall, Steve
012535 - Windows Server Mgt
BB55555
L6002222
L6003333
DD33944
Destination
Approved By
Datetime
Check In
Prodloadrun1w
BB82822
Prodloadrun2w
BB82822
Host
P3333333
AB82832
Oncall, Steve
012535 - Windows Server Mgt
BB55555
L6002222
L6003333
GG22342
Refresh
Submit
2002

FIG. 20

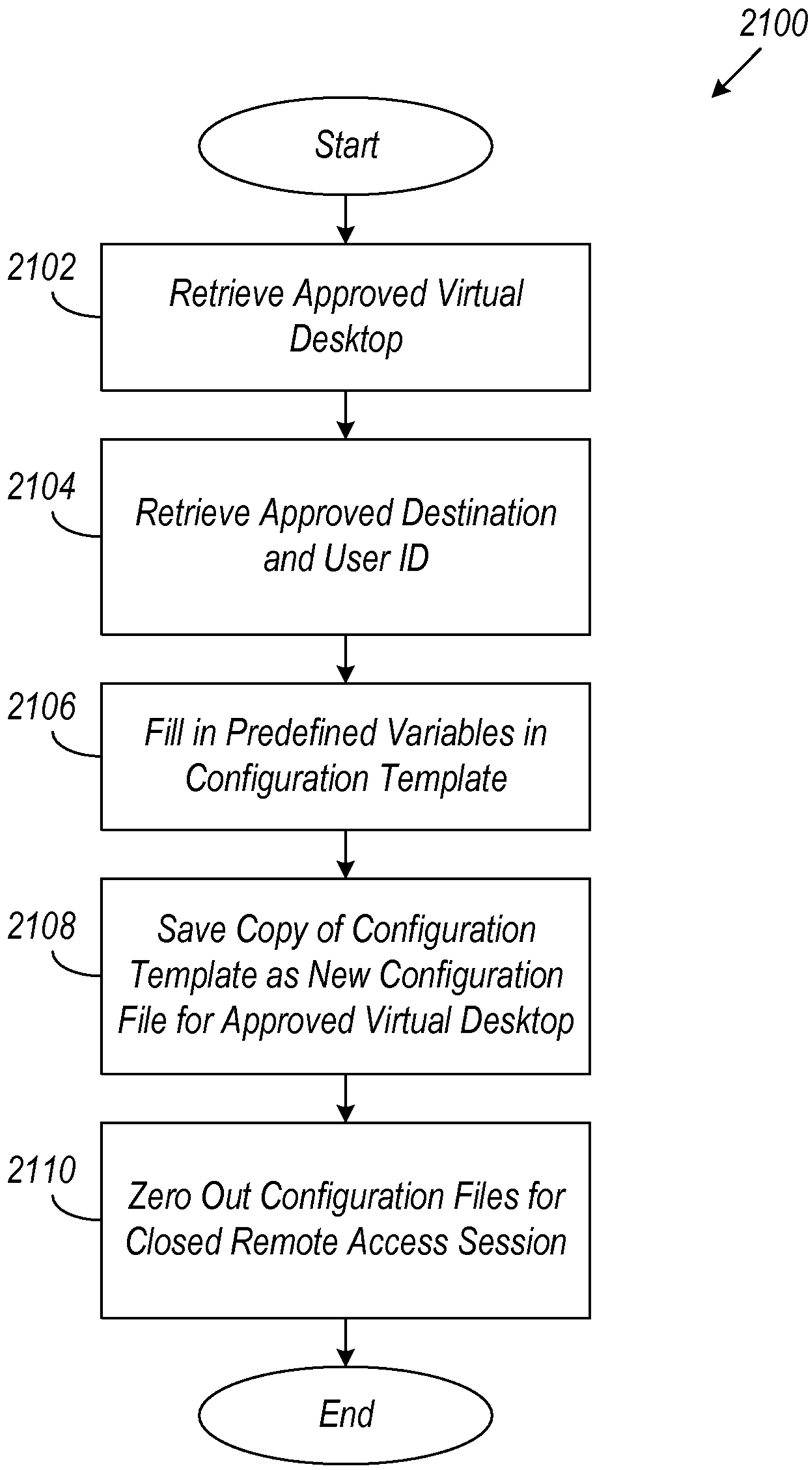
2100
Start
2102
Retrieve Approved Virtual Desktop
2104
Retrieve Approved Destination and User ID
2106
Fill in Predefined Variables in Configuration Template
2108
Save Copy of Configuration Template as New Configuration File for Approved Virtual Desktop
2110
Zero Out Configuration Files for Closed Remote Access Session
End

FIG. 21

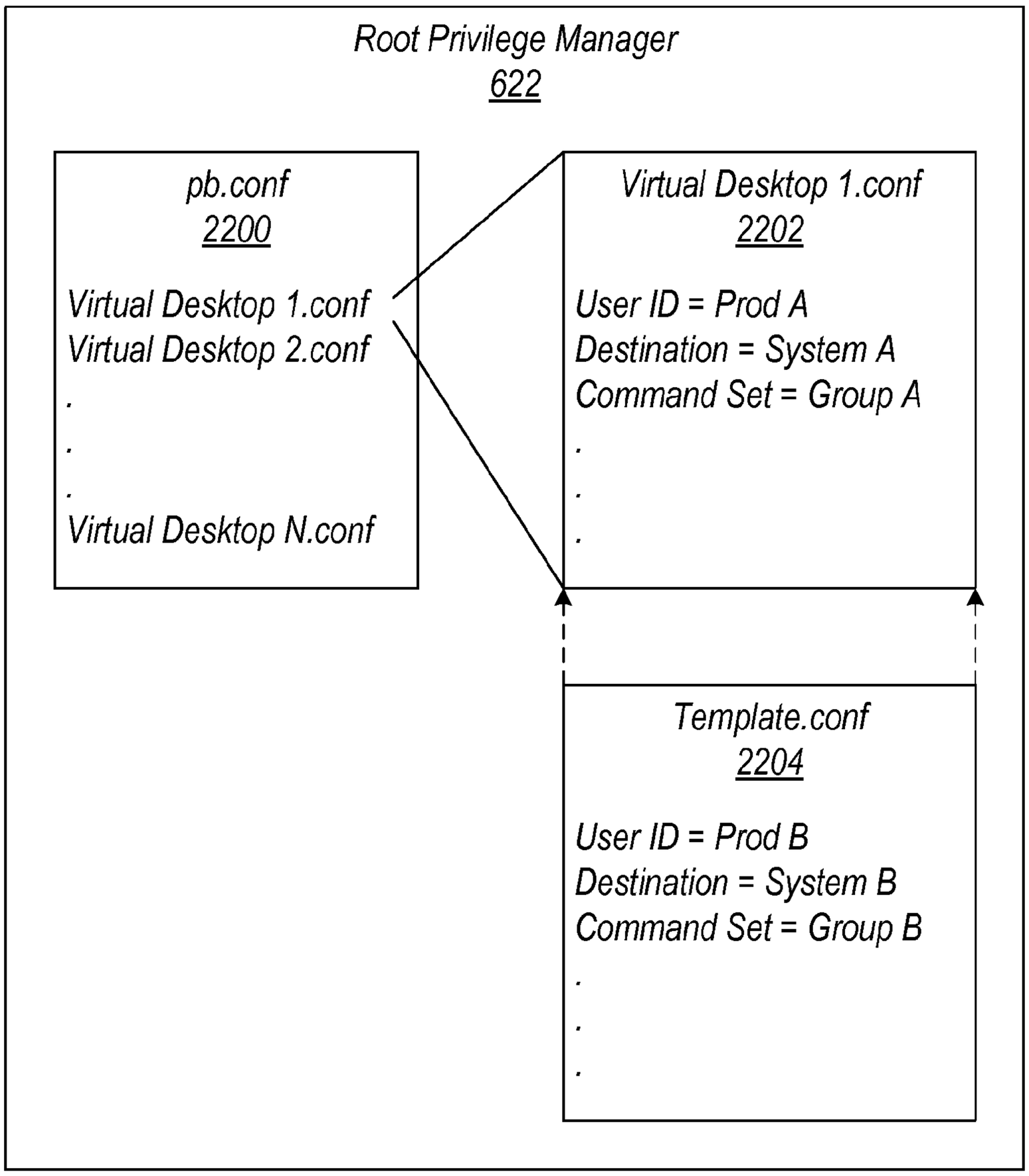
Root Privilege Manager
622
pb.conf
2200
Virtual Desktop 1.conf
Virtual Desktop 2.conf
.
.
.
Virtual Desktop N.conf
Virtual Desktop 1.conf
2202
User ID = Prod A
Destination = System A
Command Set = Group A
.
.
.
Template.conf
2204
User ID = Prod B
Destination = System B
Command Set = Group B
.
.
.

FIG. 22

ACCESS CONTROL CENTER AUTO CONFIGURATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. patent application Ser. No. 12/212,639, filed Sep. 17, 2008, entitled "ACCESS CONTROL CENTER AUTO CONFIGURATION", now abandoned and U.S. patent application Ser. No. 12/212,641, filed Sep. 17, 2008, entitled "ACCESS CONTROL CENTER AUTO CONFIGURATION", now abandoned, all of which are incorporated herein by reference in their entirety.

This application is related to U.S. patent application Ser. No. 12/178,564, filed Jul. 23, 2008, entitled "ACCESS CONTROL CENTER WORKFLOW AND APPROVAL", now abandoned and U.S. patent application Ser. No. 12/178,566, filed Jul. 23, 2008, entitled "ACCESS CONTROL CENTER WORKFLOW AND APPROVAL", currently pending and U.S. patent application Ser. No. 12/178,569, filed Jul. 23, 2008, entitled "ACCESS CONTROL CENTER WORKFLOW AND APPROVAL", now abandoned, all of which are incorporated herein by reference in their entirety.

This application is related to and U.S. patent application Ser. No. 12/208,323, filed Sep. 10, 2008, entitled "ACCESS CONTROL CENTER AUTO LAUNCH", now U.S. Pat. No. 8,707,397 and U.S. patent application Ser. No. 12/208,325, filed Sep. 10, 2008,entitled "ACCESS CONTROL CENTER AUTO LAUNCH", now abandoned and U.S. patent application Ser. No. 12/208,327, filed Sep. 10, 2008, entitled "ACCESS CONTROL CENTER AUTO LAUNCH", now abandoned and U.S. patent application Ser. No. 14/257,560, filed Apr. 21, 2014, entitled "ACCESS CONTROL CENTER AUTO LAUNCH", currently pending, all of which are incorporated herein by reference in their entirety.

This application is related to U.S. patent application Ser. No. 12/180,480, filed Jul. 25, 2008, entitled "DATABASE FOR ACCESS CONTROL CENTER", now U.S. Pat. No. 8,271,528 and U.S. patent application Ser. No. 12/180,482, filed Jul. 25, 2008, entitled "DATABASE FOR ACCESS CONTROL CENTER", now abandoned and U.S. patent application Ser. No. 13/622,070, filed Sep. 18, 2012, entitled "DATABASE FOR ACCESS CONTROL CENTER ", now abandoned, all of which are incorporated herein by reference in their entirety.

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TECHNICAL FIELD

The disclosed embodiments relate generally to computer and data security and, more specifically, to systems and methods for providing access to computers and data in a secure manner.

BACKGROUND

Companies often engage the services of third-party contractors to fill their IT (information technology) and technical

support needs. This use of outside technical support personnel may be necessitated by a number of reasons, including restrictions on new hires within a company, a specific efficiency or technical expertise of the outside personnel, inconvenient or undesirable working hours (e.g., evening or holiday shifts), and the like.

To perform their services, however, the outside technical support personnel must have access to the company's IT infrastructure and business applications, including computer systems, networks, programs, and the like. Unfortunately, granting outside technical support personnel access to a company's IT infrastructure and business applications can create a number of risks, such as lost and/or stolen data, unauthorized access to critical and/or highly sensitive systems, and the like. Indeed, many of the same risks may exist to some degree even with the company's own internal technical support personnel.

Accordingly, what is needed is a way to minimize or eliminate the risks associated with allowing access to a company's IT infrastructure and business applications. More specifically, what is needed is a way to provide controlled or limited access to the company's IT infrastructure and business applications, and to provide such access on an as-needed basis.

SUMMARY

The disclosed embodiments are directed to methods and systems for providing controlled or limited access to a company's IT infrastructure and business applications on an as-needed basis. In one implementation, an access control center (ACC) may be established for restricting the access by technical support personnel to the company's IT infrastructure and business applications. Thin client terminals with limited functionality may then be set up in the ACC for use by the technical support personnel. The thin client terminals may be selectively connected to workstations outside the ACC that operate as virtual desktops. The virtual desktops may provide the technical support personnel with indirect and temporary access to the company's IT infrastructure and business applications. An ACC application may be used to automatically establish the connection between the thin client terminals to the virtual desktops, and the virtual desktops to the IT infrastructure and business applications. The ACC application may include an auto configuration module for automatically configuring a root privilege manager and jump server. Such an arrangement minimizes or eliminates the risks associated with allowing technical support personnel access to the company's IT infrastructure and business applications.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other advantages of the disclosed embodiments will become apparent from the following detailed description and upon reference to the drawings, wherein:

FIG. **1** illustrates an exemplary access control infrastructure including an access control center (ACC) for controlling access to a company's IT infrastructure and business applications according to the disclosed embodiments;

FIG. **2** illustrates an exemplary computer system that may be used as an incident manager terminal and/or ACC manager terminal according to the disclosed embodiments;

FIG. **3** illustrates an exemplary computer system that may be used as a thin client terminal according to the disclosed embodiments;

FIG. **4** illustrates an exemplary computer system that may be used as a virtual desktop according to the disclosed embodiments;

FIG. **5** illustrates the exemplary virtual desktop according to the disclosed embodiments in more detail;

FIG. **6** illustrates an exemplary computer system that may be used as an ACC server according to the disclosed embodiments;

FIG. **7** illustrates an exemplary ACC application according to the disclosed embodiments;

FIG. **8** illustrates an exemplary ACC launch routine according to the disclosed embodiments;

FIG. **9** illustrates an exemplary ACC database according to the disclosed embodiments;

FIG. **10** illustrates the exemplary ACC database according to the disclosed embodiments in more detail;

FIG. **11** illustrates an exemplary sequence diagram showing operation of the access control infrastructure according to the disclosed embodiments;

FIG. **12** illustrates an exemplary incident assignment screen according to the disclosed embodiments;

FIG. **13** illustrates an exemplary pending requests screen according to the disclosed embodiments;

FIG. **14** illustrates an exemplary active sessions screen according to the disclosed embodiments;

FIG. **15** illustrates an exemplary ACC logon screen according to the disclosed embodiments;

FIG. **16** illustrates an exemplary remote access screen according to the disclosed embodiments;

FIG. **17** illustrates an exemplary virtual desktop logon screen according to the disclosed embodiments;

FIG. **18** illustrates an exemplary destination request screen according to the disclosed embodiments;

FIG. **19** illustrates an exemplary destination request status screen according to the disclosed embodiments;

FIG. **20** illustrates an exemplary active sessions screen according to the disclosed embodiments;

FIG. **21** illustrates an exemplary root privilege manager according to the disclosed embodiments; and

FIG. **22** illustrates an exemplary method that may be used to implement an auto configuration module according to the disclosed embodiments.

DETAILED DESCRIPTION

The drawings described above and the written description of specific structures and functions below are not presented to limit the scope of what has been invented or the scope of the appended claims. Rather, the drawings and written description are provided to teach any person skilled in the art to make and use the innovations for which patent protection is sought. Those skilled in the art will appreciate that not all features of a commercial embodiment of the innovations are described or shown for the sake of clarity and understanding.

Persons of skill in this art will also appreciate that the development of an actual commercial embodiment incorporating aspects of the innovations will require numerous implementation-specific decisions to achieve the developer's ultimate goal for the commercial embodiment. Such implementation-specific decisions may include, and likely are not limited to, compliance with system-related, business-related, government-related and other constraints, which may vary by specific implementation, location and from time to time. While a developer's efforts might be complex and time-consuming in an absolute sense, such efforts would be, nevertheless, a routine undertaking for those of skill in this art having benefit of this disclosure.

It should be understood that the embodiments disclosed and taught herein are susceptible to numerous and various modifications and alternative forms. Thus, the use of a singular term, such as, but not limited to, "a" and the like, is not intended as limiting of the number of items. Also, the use of relational terms, such as, but not limited to, "top," "bottom," "left," "right," "upper," "lower," "down," "up," "side," and the like, are used in the written description for clarity in specific reference to the drawings and are not intended to limit the scope of the innovation or the appended claims.

Particular embodiments are now described with reference to block diagrams and/or operational illustrations of methods. It should be understood that each block of the block diagrams and/or operational illustrations, and combinations of blocks in the block diagrams and/or operational illustrations, may be implemented by analog and/or digital hardware, and/or computer program instructions. Computer programs instructions for use with or by the embodiments disclosed herein may be written in an object oriented programming language, conventional procedural programming language, or lower-level code, such as assembly language and/or microcode. The program may be executed entirely on a single processor and/or across multiple processors, as a stand-alone software package or as part of another software package. Such computer program instructions may be provided to a processor of a general-purpose computer, special-purpose computer, ASIC, and/or other programmable data processing system.

The executed instructions may also create structures and functions for implementing the actions specified in the mentioned block diagrams and/or operational illustrations. In some alternate implementations, the functions/actions/structures noted in the drawings may occur out of the order noted in the block diagrams and/or operational illustrations. For example, two operations shown as occurring in succession, in fact, may be executed substantially concurrently or the operations may be executed in the reverse order, depending on the functionality/acts/structure involved.

Turning now to FIG. **1**, an exemplary infrastructure **100** is shown that is capable of being used to control access to a company's IT infrastructure and business applications, including computer systems, networks, and software programs. As alluded to above, it is often necessary for a company to provide access to such systems, networks, and programs to third-party technical support personnel. The infrastructure **100** may be used to limit or control this access by granting to the third-party technical support personnel only indirect and temporary access to the computer systems, networks, and software applications. Indeed, where applicable, the infrastructure **100** may also be used to limit access by the company's own internal technical support personnel. Accordingly, all third-party as well as internal company technical support personnel are henceforth referred to herein simply as "technical support personnel."

In some embodiments, the exemplary access control infrastructure **100** may include an area called an access control center (ACC) **102** from which access to the company's IT infrastructure and business applications may be controlled. Such an ACC **102** may be, for example, a secure room or other enclosed area within the company where the technical support personnel may enter in order to access to the company's IT infrastructure and business applications. Physical entry to the ACC **102** may then be restricted using available security measures, including badges, key cards, bio scans, and the like. However, such physical security measures may not be needed if the identities of the technical support personnel are verifiable in other ways, for example, through user IDs, passwords, access codes, and the like. These latter forms of verification

are particularly useful when the ACC **102** is located at a remote or offsite location, for example, another city, state, or country, where it may be difficult for the company to implement and maintain control over physical security measures.

Within the ACC **102**, a plurality of computing terminals may be provided, including one or more incident manager terminals **104**, ACC manager terminals **106**, and thin client terminals **108**. The term "incident" is used herein to refer to any IT event or condition, unexpected or otherwise, that may adversely impact an important operation of the company and therefore requires immediate resolution by the technical support personnel. Such an incident typically includes major malfunctions, for example, a suddenly slow or unresponsive Web site, dropped network connections, loss of access to databases, and the like. However, an incident may also include minor operational glitches, updates, and rollouts that, while not requiring immediate resolution, still need to be attended to at some point. Thus, as used herein, an "incident" may include any IT event or condition, whether major or minor, that requires the attention of the technical support personnel.

Referring first to the incident manager terminals **104**, these terminals may be used by authorized individuals referred to herein as "incident managers" to manage the technical support personnel of the ACC **102**. The incident managers generally are responsible for receiving notice of an incident, gathering any information needed about the incident, then assigning the appropriate technical support personnel to work on the incident. To this end, the incident manager terminals **104** may be general purpose computers with full functionality (e.g., hard drives, CD-ROM drives, etc.) and a full set of the software applications used in the company (e.g., e-mail, word processor, database tools, spreadsheet, Web browser, etc.). This allows the incident managers to perform their functions with maximum flexibility and functionality.

The ACC manager terminals **106**, like the incident manager terminals **104**, may also be general purpose computers that are fully functional and have a full complement of applications. These terminals **106** may be used by authorized individuals referred to herein as "ACC managers" to manage the remote access aspect of the ACC **102**. In general, the ACC managers are responsible for granting the technical support personnel selected by the incident managers access to the company's IT infrastructure and business applications needed to resolve an incident. The ACC managers may selectively provide this access as needed based on the type of incident needing resolution, as will be further explained later herein.

As for the thin client terminals **108**, these terminals may be used by the technical support personnel as remote desktops to perform the actual work needed to resolve an incident. Unlike the incident manager terminals **104** and the ACC manager terminals **106**, the thin client terminals **108** may be dedicated computers that have mainly Web browsing and remote desktop functionality. Thus, functionality such as electronic messaging, Internet access, file transfer, copy/paste, and the like may be disabled on the thin client terminals **108** in some implementations. Such thin client terminals **108** may be software-based thin clients, hardware-based thin clients, or a combination of both. Access to the company's IT infrastructure and business applications may then be provided through the thin client terminals **108** on a per-incident basis. In this way, the technical support personnel may still access the company's IT infrastructure and business applications, but with minimal risk to the security of the infrastructure and business applications.

In addition to the above, an ACC firewall **110** may be provided to prevent unauthorized access to the incident manager terminals **104**, ACC manager terminals **106**, and thin client terminals **108** from outside the ACC **102**. Another firewall **112**, which may be a business-to-business (B2B) firewall, may be provided to prevent unauthorized access to a proxy server **114**, which may be an extended mark-up language (XML) gateway server. An additional firewall **116**, which may be an enclave firewall, may be provided to prevent unauthorized access to an ACC server **118** and an ACC database **120**. Yet another firewall **122**, which may be a third-party electronic community (EC) firewall, may be provided to prevent unauthorized access to a plurality of virtual desktops **124**. These firewalls **110**, **112**, **116**, and **122** may be implemented using standard firewall technology known to those having ordinary skill in the art and are therefore not discussed in detail here.

With respect to the proxy server **114**, as the name implies, the proxy server **114** may operate as a proxy between the ACC server **118** and ACC database **120** and the ACC **102**. The proxy server **114** may be located outside the ACC **102** and may offer the only path from the ACC **102** and the virtual desktops **124** through which the ACC server **118** and ACC database **120** may be accessed. This isolation helps prevent any unauthorized access to the ACC server **118** and ACC database **120**, thus ensuring that the security and integrity of these systems are not easily compromised.

The security of the ACC server **118** and the ACC database **120** is particularly important considering their roles in controlling the access given to the technical support personnel. For example, when technical support personnel are assigned to incidents, the ACC server **118** may confirm the identities of the technical support personnel. The ACC server **118** may perform this confirmation, for example, by communicating with an authentication server **126**, which may be any suitable authentication server (e.g., Microsoft Active Directory), to obtain verification of the identities of the technical support personnel. Similarly, when user IDs, passwords, or other credentials for the company's IT infrastructure and business applications are needed, the ACC server **118** may obtain these credentials from the ACC database **120**. The ACC server **118** may also provide or otherwise cause these credentials to be provided directly to the IT infrastructure and business applications so that no intervention by the technical support personnel is needed. Therefore, in some implementations, the ACC server **118** and the ACC database **120** may be ensconced in a secure enclave and physical entry to the enclave may be restricted to help ensure their security.

In accordance with the disclosed embodiments, the above-mentioned access to the company's IT infrastructure and business applications may be provided through the virtual desktops **124**. Such virtual desktops **124** may be implemented using any suitable computing systems that are capable of supporting one or more virtual terminals, for example, one or more Windows™, UNIX™, or Linux™ workstations, servers, or other similar computing systems. These virtual desktops **124** may then be used to open remote access sessions to the company's IT infrastructure and business applications, depicted in FIG. **1** as one or more production, development, and/or test systems **128**. Alternatively, or in addition, the virtual desktops **124** may connect to a jump server **130** that may in turn provide access to the production, development, and/or test systems **128**. Note that the term "connect" or "connection" refers to a network connection via one of several suitable network protocols, such as Ethernet, Telnet, Remote Desktop, and similar networking protocols.

As used herein, a production system is a system or application that has already been released and is fully operational and accessible by its intended users. On the other hand, a development system is a system or application that is currently undergoing development and design.

In some embodiments, the selection of which virtual desktops **124** to allow the technical support personnel to use may depend on the particular production, development, and/or test system **128** that needs service. The reason is because in some embodiments, certain virtual desktops **124** may be pre-assigned to certain production, development, and/or test systems **128** and may only have the software programs or tools for those production, development, and/or test systems **128**. Such software programs or tools may include, for example, text editing tools, file management tools, software emulation tools, and other problem-solving/troubleshooting tools. The pre-assignment may be based on certain predefined service areas, for example, type of operating system (e.g., Windows, UNIX, etc.), type of computing system (e.g., server, mainframe, etc.), type of software application (e.g., accounting, inventory, etc.), and the like. These pre-assignments help ensure that the virtual desktops **124** will have the necessary software programs or tools needed for their respective service areas. In other embodiments, however, all virtual desktops **124** may be loaded with the software programs and tools needed to work on all service areas. In still other embodiments, the required software programs or tools may be loaded on the virtual desktops **124** dynamically or on an as-needed basis. In the latter embodiments, predefined profiles may be used that specify specific software programs or tools to be loaded based on the particular service area of the incident.

Note that in the above arrangement, the technical support personnel may not be allowed to acquire or otherwise know the user IDs, passwords, and other credentials being used to access the production, development, and/or test systems **128**. Instead, these user IDs, passwords, and other credentials may be obtained by the ACC server **118** from the ACC database **120** and sent in the background to the virtual desktops **124** where they are then passed to the production, development, and/or test systems **128**. In other embodiments, however, the ACC server **118** may provide the user IDs, passwords, and other credentials to the technical support personnel (via the virtual desktops **124**) who may then manually pass the credentials to the production, development, and/or test systems **128** being accessed.

In general operation, after being assigned to work on a given incident by an incident manager and approved to access a given virtual desktop **124** by an ACC manager, one of the technical support personnel may use his/her thin client terminal **108** to connect to the virtual desktop **124**. From the virtual desktop **124**, the technical support personnel may send a request to the ACC server **118** to access a particular production, development, and/or test system **128**. Once this request is granted (by the ACC manager), a remote access session may be opened from the virtual desktop **124** to the production, development, and/or test system **128**. The technical support person may then perform, through the thin client terminal **108** and the virtual desktop **124**, various tasks needed on the production, development, and/or test system **128** to resolve the incident.

In some embodiments, instead of (or in addition to) connecting the technical support person to the actual production, development, and/or test system **128**, the virtual desktop **124** may be configured to connect the technical support person to a jump server **130** that is in turn connected to the production, development, and/or test system **128**. The jump server **130** may then operate as a proxy between the technical support person and the production, development, and/or test system **128** to prevent the technical support person from directly accessing the production, development, and/or test system **128**. An example of such a jump server **130** may be a server running PowerBroker from Symark International, Inc.

Note in the foregoing that, while a single technical support person may be assigned to any given incident, it is also possible for multiple technical support persons to be assigned to the same incident so that more than one technical support person may be given access to the same production, development, and/or test system **128** (albeit through different thin client terminals **108** and virtual desktops **124**). In such an arrangement, a group of user IDs, passwords, and other credentials may be reserved or otherwise set aside for the production, development, and/or test system **128** to be used by the technical support personnel for that specific production, development, and/or test system **128**. One or more databases may then be set up to record and track which user IDs and passwords are being used by which technical support personnel on which production, development, and/or test system **128** for which incidents and so forth.

FIG. **2** illustrates an example of the incident manager terminal **104** and/or the ACC manager terminal **106** in more detail according to the disclosed embodiments. As can be seen, the incident manager terminal **104** and/or the ACC manager terminal **106** may be a general purpose computer system **200**, such as a desktop computer, laptop computer, workstation, and the like. The computer system **200** typically includes a bus **202** or other communication mechanism for communicating information and a processor **204** coupled with the bus **202** for processing information. The computer system **200** may also include a main memory **206**, such as a random access memory (RAM) or other dynamic storage device, coupled to the bus **202** for storing computer-readable instructions to be executed by the processor **204**. The main memory **206** may also be used for storing temporary variables or other intermediate information during execution of the instructions to be executed by the processor **204**. The computer system **200** may further include a read-only memory (ROM) **208** or other static storage device coupled to the bus **202** for storing static information and instructions for the processor **204**. A non-volatile computer-readable storage device **210**, such as a magnetic, optical, or solid state device, may be coupled to the bus **202** for storing information and instructions for the processor **204**.

The computer system **200** may be coupled via the bus **202** to a display **212**, such as a cathode ray tube (CRT) or liquid crystal display (LCD), for displaying information to a user. An input device **214**, including, for example, alphanumeric and other keys, may be coupled to the bus **202** for communicating information and command selections to the processor **204**. Another type of user input device may be a cursor control **216**, such as a mouse, a trackball, or cursor direction keys for communicating direction information and command selections to the processor **204**, and for controlling cursor movement on the display **212**. The cursor control **216** typically has two degrees of freedom in two axes, a first axis (e.g., X axis) and a second axis (e.g., Y axis), that allow the device to specify positions in a plane.

The term "computer-readable instructions" as used above refers to any instructions that may be performed by the processor **204** and/or other components. Similarly, the term "computer-readable medium" refers to any storage medium that may be used to store the computer-readable instructions. Such a medium may take many forms, including, but not limited to, non-volatile media, volatile media, and transmission media. Transmission media may include coaxial cables,

copper wire and fiber optics, including wires of the bus **202**. Transmission may take the form of acoustic or light waves, such as those generated during radio frequency (RF) and infrared (IR) data communications. Common forms of computer-readable media may include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, any other magnetic medium, a CD ROM, DVD, any other optical medium, punch cards, paper tape, any other physical medium with patterns of holes, a RAM, a PROM, an EPROM, a FLASH EPROM, any other memory chip or cartridge, a carrier wave, or any other medium from which a computer can read.

The computer system **200** may also include a communication interface **218** coupled to the bus **202**. The communication interface **218** typically provides a two way data communication coupling between the computer system **200** and the network **110**. For example, the communication interface **218** may be an integrated services digital network (ISDN) card or a modem used to provide a data communication connection to a corresponding type of telephone line. As another example, the communication interface **218** may be a local area network (LAN) card used to provide a data communication connection to a compatible LAN. Wireless links may also be implemented. Regardless of the specific implementation, the main function of the communication interface **218** is to send and receive electrical, electromagnetic, optical, or other signals that carry digital data streams representing various types of information.

As mentioned above, the incident manager terminal **104** and/or the ACC manager terminal **106** may contain a full complement of applications commonly used in the company. These applications may be run from the storage device **210** of the computer system **200** and may include, for example, an e-mail client **220**, a Web browser **222**, a word processor **224**, a database program **226**, and the like. Other applications not expressly shown may include a spreadsheet program, a graphics program, and the like. The reason for providing a full complement of applications is to enable the incident and/or ACC managers to perform whatever tasks are needed, such as gathering information and communicating with others within the company, and also because the incident and/or ACC managers are typically authorized company employees and therefore present less of a security risk than the technical support personnel.

In some embodiments, however, rather than deploying a general purpose computer having a full complement of applications for the incident manager terminal **104** and/or the ACC manager terminal **106**, it is also possible to use a computer having limited functionality and a reduced set of applications, similar to the thin client terminal **108**. Any additional functionality and/or applications that may be needed by the incident and/or ACC managers may then be provided, for example, from a remotely located server. Such embodiments may be particularly useful, for example, where security for the ACC **102** may be difficult to maintain.

FIG. **3** illustrates an example of a thin client terminal **108** in more detail according to the disclosed embodiments. As explained above, each thin client terminal **108** may be a dedicated computer system **300** with reduced functionality that may be used to remotely access the virtual desktops **124**. The dedicated computer system **300** may be a desktop computer, laptop computer, workstation, and the like, but is preferably a laptop computer, as these computers typically have their own battery and do not need a backup power supply. Such a dedicated computer system **300** may contain many of the same components as the general purpose computer system **200** of FIG. **2**, including a bus **302**, a processor **304**, a main memory **306**, a ROM **308**, a storage device **310**, a display **312**, an input device **314**, a cursor control **316**, and a communication interface **318**.

However, unlike the general purpose computer system **200**, the dedicated computer system **300** may simply have a Web browser **320** and a remote desktop client **322** stored on its storage device **310**. Where the operating system running on the dedicated computer system **300** is a Microsoft Windows operating system, the remote desktop client **322** may be the Remote Desktop Client built in to certain versions of the Windows operating system. Examples of such a dedicated computer system **300** may include Hewlett-Packard Company's Thin Clients, Wyse Technology's WinTerms, NeoWare, Inc.'s Appliances, and the like.

The thin client terminal **108** may then be used to remotely access one of the virtual desktops **124** (through the firewalls **110** and **122**) according to the disclosed embodiments. An example of the virtual desktops **124** is shown in FIG. **4**, where a workstation **400** or similar computing system may be used to implement one or several virtual desktops **124**. The workstation **400** may contain many of the same components, or a locked down version thereof, as the general purpose computer system **200** of FIG. **2**, such as a bus **402**, a processor **404**, a main memory **406**, a ROM **408**, a storage device **410**, a display **412**, an input device **414**, a cursor control **416**, and a communication interface **418**.

In accordance with the disclosed embodiments, the workstation **400** may have installed thereon a virtual desktop manager **420** for providing one or more virtual desktops **124**. The virtual desktop manager **420** may be any terminal service that is capable of supporting one or more of the virtual desktops **124**, two of which are shown here as Virtual Desktops A and B, on the workstation **400**. Examples of virtual desktop managers **420** that may be used may include Microsoft Windows Terminal Service, Virtual Desktop Infrastructure from VMware, Inc., and the like. In the present implementation, because the thin client terminals **108** are configured to use Windows' Remote Desktop Client (as opposed to some other remote access application) to access the virtual desktops **124**, the virtual desktops **124** may be Windows-based virtual desktops. In alternative implementations, however, other virtual desktops **124** known to those having ordinary skill in the art may certainly be used without departing from the disclosed embodiments.

FIG. **5** illustrates an example of one of the virtual desktops **124** in more detail according to the disclosed embodiments. As can be seen, the virtual desktop **124** may provide a number of applications, including a remote desktop server **500**, a Web browser **502**, one or more remote access applications **504**, and one or more software programs or tools **506** for resolving/troubleshooting incidents. Note that each technical support person may be allowed to access one virtual desktop **124** at a time and typically stays on the same virtual desktop **124** until he/she has resolved the incidents that have been assigned to him/her (or until his/her shift is over).

In general, the remote desktop server **500** may function to establish a remote desktop session with the remote desktop client **322** (see FIG. **3**) of the thin client terminals **108**. Such a remote desktop server **500** may be the Remote Desktop Server available in certain versions of Windows where, as here, the remote desktop client **322** being used is the Remote Desktop Client available in certain versions of Windows. Of course, other remote desktop servers **500** may be used with other operating systems without departing from the scope of the disclosed embodiments.

As for the Web browser **502**, any suitable Web browser may be used, such as Internet Explorer, Mozilla, Netscape, and the

like. Such a Web browser may then be used by the technical support personnel to access the ACC server **118** from the virtual desktop **124**.

The one or more remote access applications **504** may similarly be any suitable remote access applications **504** that are capable of opening a remote access session with either the production, development, and/or test systems **128**, or the jump server **130**. Examples of remote access applications **504** that may be used include PuTTY for UNIX-based systems, Remote Desktop for Windows-based systems, PCOMM for IBM mainframes, and the like.

Finally, the software programs or tools **506** may be any suitable software tools commonly used by those having ordinary skill in the art for resolving/troubleshooting incidents, such as text editing tools, file management tools, software emulation tools, and the like.

Although not expressly shown, in some embodiments, one or more ACC databases may also be provided on the ACC server **118** to record and track the technical support personnel's access to the production, development, and/or test system **128**. Examples of information that may be tracked include which technical support personnel are using which virtual desktop **124** to access which production, development, and/or test system **128** to resolve which incident using which user IDs and passwords, and the time, date and duration that the technical support personnel accessed the production, development, and/or test system **128**, and the like. In alternative embodiments, this information may also be stored in the ACC database **120**.

Turning now to FIG. **6**, an example of the ACC server **118** is shown according to the disclosed embodiments. The ACC server **118**, as the name suggests, may be a server computer **600**, or it may also be a workstation, personal computer, and the like. The server computer **600** may contain many of the same components as the general purpose computer system **200** of FIG. **2**, for example, a bus **602**, a processor **604**, a main memory **606**, a ROM **608**, a storage device **610**, a display **612**, an input device **614**, a cursor control **616**, and a communication interface **618**. Such an ACC server **118** may then be used to provide indirect and temporary access to the production, development, and/or test systems **128** of the company. To this end, an ACC application **620** may be present on the ACC server **118** to help control or limit access to the production, development, and/or test systems **128** of the company. Even after access is granted, a root privilege manager **622** may be present in some embodiments to limit the types of activities that may be performed and/or programs that may be run on certain ones of the production, development, and/or test systems **128**.

FIG. **7** illustrates the ACC application **620** according to the disclosed embodiments in more detail. In some embodiments, the ACC application **620** may be a Web-based application that has a plurality of Web pages, each page providing a different set of functions and options. Users, including incident managers, ACC managers, and technical support personnel, may then access certain pages of the ACC application **620** by entering the URL (uniform resource locator) of the ACC application **620** into a standard Web browser, such as Internet Explorer, Mozilla, Netscape, and the like. As can be seen, the ACC application **620** may be composed of a number of functional components, including a personnel verification module **700**, an access control module **702**, a credentials manager **704**, an auto logon module **706**, an auto configuration module **708**, and a logging/tracking module **710**. Following is a description of the functionality of each component.

The personnel verification module **700** may operate to verify the identity of the users who access the ACC application **620**. For example, after technical support personnel enter the URL (uniform resource locator) of the ACC application **620**, they may be required to provide their user IDs and passwords in order to access the ACC application **620**. Upon receiving a user ID and password, the personnel verification module **700** may connect to the authentication server **126** (see FIG. **1**) of the company and verify that the user ID and password are valid. If they are verified, then the technical support personnel will be allowed to proceed further. Verification of the user ID and password may be performed using any technique known to those having ordinary skill in the art without departing from the scope of the disclosed embodiments. Examples of software tools that may be used to verify user IDs and passwords are available from Quest Software, Inc.

The access control module **702** may operate to control access to the virtual desktops **124** and hence the production, development, and/or test systems **128** for the ACC application **620**. That is, the access control module **702** may require that all access to the virtual desktops **124** be approved by the ACC manager before the technical support personnel are allowed to connect to the virtual desktops **124**. In addition, once the ACC manager has granted approval for a technical support person to access a given virtual desktop **124**, the access control module **702** may automatically connect the technical support person's thin client terminal **108** to that virtual desktop **124**, thereby avoiding intervention by the technical support person. This may be accomplished, for example, via the Web browser **320** interacting in the background with the remote desktop client **322** (see FIG. **3**) on the thin client terminal **108**, particularly where the Web browser **320** is Internet Explorer and the remote desktop client **322** is Windows' Remote Desktop Client. The technical support person may thereafter use that virtual desktop **124** until he/she resolves the incident or his/her work day is completed.

In some embodiments, the particular virtual desktops **124** for which the technical support personnel may be approved may depend on the type of incidents that have been assigned to the technical support personnel. For example, if a technical support person has been assigned a UNIX-related incident and an IBM mainframe-related incident, then he/she may receive approval for a virtual desktop **124** that contains certain remote access applications **504** (see FIG. **5**), such as PuTTY and PCOMM, but not other remote access applications **504**, such as Remote Desktop. On the other hand, if a technical support person has only been assigned a UNIX-related incident, then he/she may receive approval for a virtual desktop **124** that only contains PuTTY, but not PCOMM or Remote Desktop. This arrangement provides greater selection and control over the particular applications that may be used by the technical support person while he/she is on the virtual desktop **124**. In alternative embodiments, however, every application that may be needed by any technical support person may be provided beforehand on certain ones of the virtual desktops **124**. This latter arrangement allows for greater flexibility in that these virtual desktops **124** may be approved for the technical support personnel regardless of the types of incidents the technical support personnel have been assigned.

In some embodiments, instead of the access control module **702** automatically connecting the technical support personnel's thin client terminals **108** to the virtual desktops **124**, the connection may be accomplished manually, for example, through a hyperlink, pointer, or similar navigation mechanism. The access control module **702** may provide (or may cause to be provided) this navigation mechanism to the technical support personnel once the ACC manager has granted

approval to the technical support personnel to access the virtual desktops **124**. The technical support personnel may thereafter manually deploy the navigation mechanism to connect the thin client terminals **108** to the virtual desktops **124**.

After a connection to the virtual desktops **124** has been established, the access control module **702** may require the technical support personnel to obtain further approval from the ACC manager to connect to the production, development, and/or test systems **128**. In some embodiments, the technical support personnel may obtain this approval by selecting a particular production, development, and/or test system **128**, for example, from a drop down list generated by the access control module **702** and submitting a request for access to that production, development, and/or test system **128** via the virtual desktop **124**. The ACC manager may then approve or not approve the request as appropriate via the access control module **702**.

Once the ACC manager has approved access to a production, development, and/or test system **128**, the credentials manager **704** may operate to retrieve any user IDs, passwords, and other credentials needed to access the production, development, and/or test system **128**. The credentials manager **704** may perform this function by connecting to the ACC database **120** (see FIG. **1**) and looking up the credentials for the production, development, and/or test systems **128** to be accessed by the technical support personnel. As mentioned previously, these credentials may be a group of user IDs, passwords, and other credentials reserved or otherwise set aside for the production, development, and/or test systems **128** to be used by the technical support personnel for specific production, development, and/or test systems **128**. In some embodiments, instead of the credentials manager **704** automatically retrieving the credentials for a given incident, the ACC manager may manually assign one of the credentials to be used, such as a system ID (or production ID), and the credentials manager **704** may automatically retrieve all other needed credentials (e.g., passwords, etc.) corresponding to the system ID selected by the ACC manager. A system ID (or production ID), as understood by those having ordinary skill in the art, is typically a user ID that is associated with a particular system, as opposed to one that is associated with a particular user.

In accordance with the disclosed embodiments, the credentials manager **704** may provide the credentials retrieved for a particular production, development, and/or test systems **128** to the auto logon module **706**. The auto logon module **706** may thereafter use the credentials to connect the virtual desktops **124** to the production, development, and/or test systems **128** requested by the technical support personnel. More specifically, the auto logon module **706** may open a remote session between the virtual desktops **124** and the production, development, and/or test systems **128** requested by the technical support personnel. The auto logon module **706** may open this remote session by causing to be downloaded to the virtual desktops **124** a launch routine (see FIG. **8**) that may be executed by the technical support personnel.

The launch routine may be, for example, a Java-based routine that calls an appropriate one of the remote access application **504** (see FIG. **5**) when executed by the technical support personnel in order to open a remote session between the virtual desktops **124** and the production, development, and/or test systems **128**. The particular remote access application **504** that is called (e.g., PuTTY for UNIX-based systems, Remote Desktop for Windows-based systems, PCOMM for IBM mainframes) may depend on the specific credentials provided by the credentials manager **704**. These credentials, in turn, may correspond to the production, development, and/or test systems **128** requested by the technical support personnel. It is also possible in some embodiments to automatically execute the launch routine as soon as approval is granted by the ACC manager to access the production, development, and/or test systems **128** without any intervention by the technical support personnel. The launch routine may thereafter automatically (i.e., in the background) pass the credentials to the production, development, and/or test systems **128** via the remote access application **504** to thereby connect the virtual desktops **124** to the production, development, and/or test systems **128** requested by the technical support personnel.

The above arrangement has an advantage in that the technical support personnel are not exposed to the credentials and therefore cannot misuse them. In other embodiments, however, instead of automatically providing the credentials directly to the production, development, and/or test systems **128**, the credentials manager **704** may provide the credentials in text form to the technical support personnel. The technical support personnel may then use the credentials to manually log on to the production, development, and/or test systems **128**.

In some embodiments, instead of opening a remote session directly to a production, development, and/or test system **128**, the launch routine may open a remote session to the jump server **130** (see FIG. **1**). The jump server **130** may then provide the technical support personnel with access to the production, development, and/or test system **128**. To this end, the jump server **130** may operate in conjunction with the root privilege manager **622** to limit the types of activities that may be performed and/or programs that may be run on certain ones of the production, development, and/or test systems **128**. For example, administrative actions, such as installing new software, may be allowed only under some user IDs (or system IDs), while troubleshooting actions, such as analyzing error messages, may be allowed only under other user IDs (or system IDs), through appropriate configuration of the jump server **130** and root privilege manager **622**. An example of a commercially-available product embodying the functionality of the jump server **130** and root privilege manager **622** for UNIX-based systems is PowerBroker from Symark International, Inc. Similar products are available for other operating systems and the disclosed embodiments are not limited to any particular operating system.

In order to function properly, the jump server **130** needs to be informed as to which restrictions to place on which user IDs. This information may be retrieved by the jump server **130** from a configuration file that typically resides on the ACC server **118** and is associated with or controlled by the root privilege manager **622**. The configuration file may specify, for example, the production, development, and/or test systems **128** that may be accessed, the commands that may performed, the programs that may be run, and the like for a given user ID. Then, when a request is received under that user ID for a certain production, development, and/or test systems **128**, the jump server **130** may grant or deny the request according to the information in the configuration file.

The configuration files for PowerBroker and similar products, however, tend to be rigid in nature and that the files specify static values as opposed to dynamic values (i.e., values that may be retrieved in real time, for example, from a designated database). This constrains the ability of the jump server **130** to accept new or updated configuration information in real time, or on-the-fly, as such information must first be entered into the configuration file before the jump server **130** can use the information. PowerBroker and similar products do allow the jump server **130** to reference multiple configuration files, for example, one configuration file for each

virtual desktop **124**, using "include" and similar programming mechanisms. However, while this option may provide a degree of flexibility for the ACC manager, the multiple configuration files still contain essentially static configuration information. Thus, a virtual desktop **124** that has been set up to access a particular production, development, and/or test system **128** using one user ID could not typically be used to access a different system **128** using the same user ID, or the same system **128** using a different user ID, when going through the jump server **130** until that virtual desktop's configuration file has been updated accordingly.

The auto configuration module **708** helps reduce the rigidity of PowerBroker and similar products by automatically providing new or updated configuration files on-the-fly. In one embodiment, the auto configuration module **708** may be a Java-based module that is designed to automatically retrieve new or updated configuration information, for example, from the ACC database **120**, and insert the information into a configuration template. Specifically, the configuration information may be inserted into certain variables with the configuration template, such as a destination variable, user ID variable, command set variable, and the like. The completed configuration template is then saved over or otherwise replaces any previously existing configuration file. When the jump server **130** subsequently accesses the configuration file, it will obtain the new or updated configuration information. In embodiments where the jump server **130** references multiple configuration files, for example, one configuration file for each virtual desktop **124**, the auto configuration module **708** may replace whichever configuration file is needed for a given remote access session with a completed configuration template. This on-the-fly creation and placement of configuration files gives ACC managers the flexibility to authorize virtually any technical support personnel to use virtually any user ID from virtually any virtual desktop **124** to access production, development, and/or test systems **128** through the jump server **130**. Additional details regarding operation of the auto configuration module **708** is provided later herein with respect to FIGS. **21** and **22**.

Finally, the logging/tracking module **710** operates to record the activities of the technical support personnel on the thin client terminals **108**, the virtual desktops **124**, and the production, development, and/or test systems **128**. In some embodiments, the recording may be a full session capture of all activities carried out by the technical support personnel (e.g., keystroke logging, etc.). In other embodiments, however, the logging/tracking module **710** may provide a more limited recording, for example, just the activities related to the request for access (e.g., who made the request, who authorized it, to which system, etc.). The logs may be subsequently reviewed by company management to determine if any changes are needed in procedures, technical support personnel, infrastructure, and the like.

The personnel verification module **700**, access control module **702**, credentials manager **704**, auto logon module **706**, auto configuration module **708**, and logging/tracking module **710** may store and retrieve any needed data in the ACC database **120**. Such a database **120** may be any structured collection of records known to those having ordinary skill in the art, and it may be accessed by the functional components **700**, **702**, **704**, **706**, and **710** either in real time as needed, or according to some predefined schedule. The data stored in the ACC database **120** may generally be all data or information used by the functional components **700**, **702**, **704**, **706**, and **710** to carry out their various functions. Such data or information may include data or information on each incident, technical support person, incident manager, ACC manager, organizational unit, service area, virtual desktop, thin client terminal, access credentials, approval given, approval revocation, and the like. Additional details regarding the ACC database **120** is provided later herein with respect to FIGS. **9** and **10**.

Turning now to FIG. **8**, general guidelines are shown in the form of a method that may be used to implement the launch routine disclosed above. As can be seen in FIG. **8**, an exemplary method **800** for automatically opening a remote session between the virtual desktops **124** and the production, development, and/or test systems **128** may begin at block **802**, where access credentials may be obtained for the production, development, and/or test systems **128**. The access credentials may be obtained in real time as needed, for example, via the credentials manager **704**, or they may be provided to the virtual desktop along with the launch routine. As mentioned above, in some embodiments, the access credentials may be automatically retrieved for a given incident based on the production, development, and/or test systems **128** involved, or the ACC manager may manually assign one of the credentials, such as the user ID or a system ID (or production ID), and all other needed credentials corresponding to the user ID or a system ID selected by the ACC manager may be automatically retrieved.

At block **804**, the remote access application **504** corresponding to the access credentials may be determined. The determination may be conducted in real time as needed, for example, by looking up the information in an appropriate table of the ACC database **120**, or the information may be provided beforehand along with the launch routine. At block **806**, the remote access application **504** corresponding to the access credentials is called. In one implementation, the calling may be accomplished automatically by executing predefined command line instructions known to those having ordinary skill in the art. In other implementations, a technical support person may need to take one or more actions, such as clicking on a button, in order to call the remote access application **505**. Of course, other techniques for calling a remote access application **504** may also be used without departing from the scope of the disclosed embodiments. Finally, at block **808**, the access credentials are passed to the remote access application **504** in the manner known to those having ordinary skill in the art (e.g., via command line instructions, etc.).

FIG. **9** illustrates an exemplary schema for the ACC database **120**. In some embodiments, the ACC database **120** may be a relational database, but other types of databases known to those having ordinary skill in the art may also be used. As can be seen, the ACC database **120** may include several main tables that are supported by a plurality of auxiliary tables. The main tables in the example shown here may include an ACC Incident table **900** and an ACC Incident Access table **902**. The ACC Incident table **900** may be designed to store, among other things, information concerning the technical support personnel who have been authorized, and those who are available to be authorized, to resolve a given incident. The ACC Incident Access table **902** may be designed to store, among other things, information concerning the incidents and the approval granted to the technical support personnel to access one or more production, development, and/or test systems **128** in order to work on the incidents. Other main tables may also be provided in the ACC database **120** by those having ordinary skill in the art without departing from scope of the disclosed embodiments.

The auxiliary tables may then provide support for the data in the ACC Incident table **900** and the ACC Incident Access table **902**. These auxiliary tables may be simple lists in some

embodiments, or they may be arrays of two or more dimensions, as is the case for many types of lookup tables. In the example shown here, the auxiliary tables may include a Virtual Desktop table **904**, a Service Area table **906**, and a Personnel/Service Area Mapping table **908** for supporting the data in the ACC Incident table **900**. To support the ACC Incident Access table **902**, in some embodiments, there may be a System/System Access Mapping table **910**, a System Type table **912**, a System Access table **914**, and a Personnel/System Access Mapping table **916**. Other auxiliary tables may also be provided in the ACC database **120** by those having ordinary skill in the art without departing from scope of the disclosed embodiments.

The Virtual Desktop table **904** may store, among other things, information concerning the virtual desktops **124** available for use by the technical support personnel to address an incident. To this end, the Virtual Desktop table **904** may include a list of the virtual desktops **104** that are available to be assigned to a technical support person. Authorized personnel may then manually or automatically modify the Virtual Desktop table **904** (and all the other tables of the ACC database **120**) as needed from time to time in order to update the Virtual Desktop table **904** (and all the other tables of the ACC database **120**).

The Service Area table **906** may be a lookup table for, among other things, information concerning the available service areas to which the technical support personnel may be assigned to address an incident. A "service area" is in essence a logical grouping of virtual desktops **124** that have been dedicated to a particular team of technical support personnel and/or production, development, and/or test systems **128**. The logical grouping allows the workstations for those virtual desktops **124** to be preloaded with specific applications and/or software programs that may be needed by the team and/or for the production, development, and/or test systems **128**. This obviates the need to preload every workstation with every application and/or software program that may be needed on every virtual desktop **124**, thereby realizing a potential savings on software licensing and other costs.

The Personnel/Service Area Mapping table **908**, as the name suggests, may provide information linking the various technical support personnel to the service areas they support. Assignment of the technical support personnel to a given service area may be based, for example, on the particular expertise of the technical support personnel, the level of training and/or experience of the technical support personnel, and the like. Such an arrangement allows for ownership of certain production, development, and/or test systems **128** by discrete teams of technical support personnel, which may help facilitate expedited resolution of any incidents arising from those systems and in some cases.

In a similar manner, the System/System Access Mapping table **910** may link the various production, development, and/or test systems **128** to the respective access credentials for these systems. The system access credentials may be, for example, actual production credentials used by system designers and administrators to access the production, development, and/or test systems **128**, or they may be access credentials that are separately set up for the technical support team in order to grant them access to the production, development, and/or test systems **128**. In either case, it is not necessary to have a unique access credential for each technical support person, as one access credential may be shared among multiple technical support personnel. As mentioned above, however, the technical support personnel generally should not be given the access credentials in order to minimize any security risk.

The System Type table **912** may store, among other things, information concerning the types of production, development, and/or test systems **128** that may need to be accessed by the technical support personnel to resolve an incident. To this end, the System Type table **912** may include a list of various system types, such as Windows, UNIX, AIX, LINUX, whether or not the system is a host, and similar system types known to those having ordinary skill in the art.

The System Access table **914** may store information concerning the actual access credentials used in the System Access Mapping table **910** described above. To this end, the System Access table **914** may include a lookup table of the various access credentials that may be used to access the various production, development, and/or test systems **128**.

Finally, the Personnel/System Access Mapping table **916** may provide, among other things, information concerning which technical support person is linked to which access credentials. To this end, the Personnel/System Access Mapping table **916** may provide a lookup table mapping the technical support personnel to one or more system access credentials.

In addition to the real-time versions of the ACC Incident table **900** and the ACC Incident Access table **902**, in some embodiments, the ACC database **120** may also include historical, non-real-time versions of the ACC Incident table and the ACC Incident Access table, indicated at **918** and **920**, respectively. These historical versions **918** and **920** serve essentially as backup versions of the ACC Incident table **900** and the ACC Incident Access table **902**.

A more detailed implementation of the ACC database **120** is shown in FIG. **10**, where data fields have been provided by way of examples for various data tables. It should be noted that the data tables illustrated in FIG. **10** are exemplary only, and that one or more data tables may be removed from or added to the implementation of FIG. **10** without departing from the scope of the disclosed embodiments. Moreover, any one of the data tables depicted in FIG. **10** may be divided into two or more sub-tables, or two or more of the data tables may be combined into a single table, without departing from the scope of the disclosed embodiments.

In the example of FIG. **10**, the ACC database **120** may include an ACC Incident table **1000**, an ACC Incident Access table **1002**, a Virtual Desktop table **1004**, a Service Area table **1006**, a Personnel/Service Area Mapping table **1008**, a System/System Access Mapping table **1010**, a System Type table **1012**, a System Access table **1014**, and a Personnel/System Access Mapping table **1016**. The data tables in FIG. **10** generally correspond to their counterparts in FIG. **9** and therefore only a description of the individual data fields in each table is provided below.

As is customary in the database art, key icons signify data fields that are primary data fields, "FK" signify data fields that are foreign keys (i.e., keys that are primary keys in a different table), and "AK" signify data fields that are alternate keys (i.e., unique data fields that are not primary keys). In addition, conventional relationship indicators are used to show one-to-one and one-to-many relationships, respectively. For example, the ACC Incident table **1000** has a one-to-many relationship with the ACC Incident Access table **1002**.

In some embodiments, the data fields of the ACC Incident table **1000** may include an ACC Incident ID field for identifying each incident (e.g., by incident number) received by the ACC **102**. Additionally, the ACC Incident ID field may also be designated as a primary key field. Other fields may include a Personnel ID field for identifying the technical support person(s) assigned to each incident (e.g., by employee number), and Personnel Last Name and Personnel First Name

fields for recording the first and last name of the technical support person(s) assigned to the incident. Also present may be an Organizational Unit Code field and an Organizational Unit Name field for identifying the particular business units (e.g., accounting department) from which each incident arose. A Service Area Description field may be provided for identifying different logical groups of technical support personnel and/or production, development, and/or test systems **128**. A Thin Client Terminal Code may be provided for identifying the thin client terminals (e.g., by terminal number), and an Incident Manager ID field may be provided for identifying the incident manager handling the incident (e.g., by employee number). A Virtual Desktop Approval by ID field may be provided for identifying the ACC manager who provided the approval for a technical support person to access a virtual desktop, along with data fields for recording the Timestamp of the approval and the Timestamp when (e.g., time and date) the approval was revoked by the ACC manager. Finally, a Service Center Ticket Code field may be provided for recording the ACC ticket number assigned to each incident.

As for the ACC Incident Access table **1002**, this table may include an ACC Incident Access ID field for recording each system access (e.g., by access number) that has been approved, as well as the ACC Incident ID field discussed with respect to the ACC Incident table **1000**. In some embodiments, the ACC Incident Access ID field may be designated as a primary key field. Also present may be a System Access ID field for storing any access credentials (e.g., usernames, passwords, etc.) needed to access each production, development, and/or test systems **128**, along with a System Name field for storing the name of the corresponding production, development, and/or test systems **128**. An ACC incident access approved by ID field may be provided for identifying the ACC manager (e.g., by employee ID) who provided the approval for a technical support person to access a production, development, and/or test systems **128**. Finally, various Timestamp fields may be provided for recording when (e.g., time and date) the access approval was granted by the ACC manager and when the approval was revoked by the ACC manager.

Other data fields of interest may be found in the auxiliary tables and may include a System Type Descriptor field (see System Type table **1012**) for storing the system type (e.g., Windows, UNIX, AIX, LINUX, etc.), and a Physical Connection Application Name field (also in System Type table **1012**) for identifying the application (e.g., PuTTY, Remote Desktop, PCOMM, etc.) used to access the production, development, and/or test systems **128**.

Lastly, historical, non-real-time versions of the ACC Incident table **1000** and ACC Incident Access table **1002** may also be present (indicated at **1018** and **1020**) for backup purposes in some embodiments.

Note that other data fields may also be provided in the various main and auxiliary tables described above by those having ordinary skill in the art without departing from scope of the disclosed embodiments. In addition, one or more of the data fields may be manually or automatically maintained and modified as needed from time to time in order to update these one or more of the data fields. For example, one or more of the data fields, such as the System Access ID field and the like, may be linked to other databases used in the company and automatically updated as needed from time to time from those other databases.

FIG. **11** illustrates an exemplary sequence diagram showing the operation of the embodiments disclosed above in more detail. By way of example and also for ease of understanding, it will be assumed that the thin client terminals **108** and virtual desktops **114** in FIG. **11** are Windows-based and the Web browser thereon is the Internet Explorer Web browser. Note also that while the exemplary diagram in FIG. **11** combines several related events into one or more series of events, those having ordinary skill in the art will understand that different combinations of events resulting in different series of events from those shown in FIG. **11** may certainly be used without departing from the scope of the disclosed embodiments. Also, although they are present, the various firewalls **110**, **112**, **116**, and **112** discussed above with respect to FIG. **1** have been omitted from FIG. **11** for readability and economy of the description. Finally, it should be noted that FIG. **11** was not intended to illustrate every possible event of the disclosed embodiments, but only those events that are useful for an understanding the main concepts and teachings of the disclosed embodiments.

In FIG. **11**, operation may begin when an incident is reported to the ACC **102**. Various channels may be used to report an incident to the ACC **102**, such as by e-mail message, telephone call, intra-company memo, auto-generated alert, in-person communication, and the like.

An incident manager, after entering the ACC **102**, logging in to the ACC server **118** (and the ACC application **620** thereon) via an incident manager terminal **104**, and receiving notice of the incident, may enter or otherwise create a record of the incident on the ACC server **118**, indicated at **1100**. Note that the ACC server **118** may only be accessed through the proxy server **114** in order to protect the ACC server **118** from unauthorized access. The incident record may contain various information about the incident, including a description of the incident, the network address of the production, development, and/or test system **118** affected, the service area (e.g., operating system, software application, etc.) involved, and so forth. At this time, the incident manager may also assign one or more technical support personnel from a pool of technical support personnel to work on the incident. The specific technical support personnel that the incident manager may assign to the incident may depend on the service area of the incident and the particular experience and expertise of the technical support personnel.

At **1102**, an ACC manager, after entering the ACC **102** and logging in to the ACC server **118** (and the ACC application **620** thereon) via an ACC manager terminal **106**, may view the records of various incidents that are pending his/her assignment and approval for virtual desktops **114**. In some embodiments, assignment may be to general virtual desktops **114** that contain every application needed by a technical support person to resolve an incident. In other embodiments, assignment may be to specific virtual desktops **114** that are set up for specific service areas and that contain specific software programs or tools needed to resolve the incidents in those service areas.

At **1104**, a technical support person, after entering the ACC **102**, may log on to the ACC server **118** (and the ACC application **620** thereon) via a thin client terminal **108** by providing his/her user ID and password. At **1106**, the ACC server **118** may receive the user ID and password and may communicate with the authentication server **116** to verify the user ID and password of the technical support person. Assuming the user ID and password are verified, then at **1108**, the ACC server **118** may send information to the ACC manager that the technical support person has logged on and is awaiting assignment to a virtual desktop **114**.

At **1110**, the ACC manager, upon seeing the request for a virtual desktop **114**, may assign and approve one of the virtual desktops **114** for the technical support person. Once the ACC server **118** receives the assignment and approval for the

access request from the ACC manager (via the ACC manager terminal **106**), it may initiate a connection from the thin client terminal **108** of the technical support person to the assigned virtual desktop **114** using the Web browser **320** and remote desktop client **322** thereon, indicated at **1112**. It is also possible in some embodiments for the ACC server **118** to provide the thin client terminal **108** with a reference, such as a hyperlink, destination name, or similar navigation mechanism, that the technical support person may use to manually initiate the connection to the virtual desktop **114**.

The technical support person thereafter logs in to the virtual desktop **114**, indicated at **1114**, to establish a connection to the virtual desktop **114**. Once this connection is established, the technical support person may again access the ACC server **118**, but this time from the virtual desktop **114** (again, via the proxy server **114**), indicated at **1116**. If necessary, the technical support person may provide his/her user ID and password once more to the ACC server **118**. It is also possible in some embodiments for the ACC server **118** to skip the verification step (i.e., no user ID or password needed) by virtue of the technical support person now accessing the ACC server **118** from a trusted source, namely, the designated virtual desktop **114**. In some embodiments, the technical support person may retrieve information from the ACC server **118** at this time concerning the incident for which he/she has been assigned, such as the name of the production, development, and/or test system **118** involved in the incident, the status of the incident, and the like. If there are multiple incidents assigned to the technical support person, then information pertaining to all of the incidents may be retrieved at this time. The technical support person may then submit to the ACC server **118** a request to access the production, develop, and/or test system **118** for the incident to which he/she has been assigned along with a reference for the incident (e.g., incident ticket number).

At **1118**, upon seeing that a request to access a production, development, and/or test system **118** has been submitted to the ACC server **118** from the technical support person, the ACC manager may grant approval for the access if he/she deems the access to be appropriate. In some embodiments, the ACC manager may also select a set of access credentials to be used with the approved production, development, and/or test system **118** at this time.

However, in some embodiments, after the ACC manager provides approval for the access, the ACC server **118** may automatically retrieves any access credentials (e.g., user IDs, passwords, etc.) needed for the approved production, development, and/or test system **118** from the ACC database **110**, indicated at **1120**. As discussed above, in some embodiments, a group of user IDs, passwords, and other credentials may be reserved or otherwise set aside for use with specific production, development, and/or test systems **118**. The ACC server **118** may also download a launch routine (see FIG. **8**) to the virtual desktop **114**, for example, to the main memory of the virtual desktop **114**, indicated at **1122**. The launch routine may then be executed by the technical support person to open a remote session with the approved production, development, and/or test system **118**.

When executed by the technical support person, the launch routine may call an appropriate one of the remote access applications **504** residing on the virtual desktop **114** to open a remote session with the approved production, development, and/or test system **118**, indicated at **1124**. The particular remote access application **504** that is called (e.g., PuTTY for Unix-based systems, Remote Desktop for Windows-based systems, PCOMM for IBM mainframes) may depend on the specific credentials retrieved by the ACC server **118**. These credentials may be provided to the launch routine in real time by the ACC server **118** when the launch routine is executed, or they may be downloaded along with the launch routine to the virtual desktop **114** beforehand. The launch routine may thereafter automatically (i.e., in the background) pass the credentials to the production, development, and/or test systems **118** via the remote access application **504** to thereby connect the virtual desktops **114** to the production, development, and/or test systems **118**.

In some embodiments, instead of using the launch routine to open the remote session with the production, development, and/or test system **118**, the technical support person may be allowed to manually open the remote session. In that case, the ACC server **118** may send the credentials to the virtual desktop **114** of the technical support person along with a reference for the approved production, development, and/or test system **118**, such as a destination name, IP address, or similar navigation mechanism. The technical support person may then use this information to manually launch the remote access application **504**, establish a connection with the production, development, and/or test system **118**, and manually enter any credentials needed.

In still other embodiments, instead of establishing a connection from the virtual desktop **114** to the production, development, and/or test system **118**, a connection may be established from the virtual desktop **114** to the jump server **130** (see FIG. **1**). The jump server **130**, as understood by those having ordinary skill in the art, functions as a proxy that provides another layer of security between the technical support person and the production, development, and/or test system **118**. The technical support person may thereafter access the production, development, and/or test system **118** through the jump server **130**, indicated at **1126**.

Once the technical support person has resolved the incident, he/she may close the connection or check in the production, development, and/or test system **118**. The ACC manager may thereafter revoke approval for any access given to the technical support person on the ACC server **118** at this time (or at anytime throughout the process) to prevent its further usage. Similarly, the ACC manager may cause the user ID being used for the production, development, and/or test system **118** to be revoked at this time (or at anytime throughout the process) to prevent its further usage.

FIGS. **12-20** illustrate an exemplary implementation of the foregoing embodiments in the form of a series of graphical user interface screens. For example, FIG. **12** illustrates an exemplary incident assignment screen **1200** that may be presented by the ACC application **620** (via the ACC application server **118**) to an incident manager. The incident manager may then use the incident assignment screen **1200** to create a record for a given incident on the ACC application server **118**. For example, the incident manager may use the incident assignment screen **1202** to enter a ticket number of the incident and assign one or more technical personnel to the incident.

FIG. **13** illustrates an exemplary pending requests screen **1300** that may be presented by the ACC application **620** (via the ACC application server **118**) to an ACC manager to notify him/her of currently-pending requests. The pending requests screen **1300** shown here may include a virtual desktop requests section **1302** and a destination request section **1304** (which lists the production, development, and test systems **128** currently being requested). The ACC manager may then use the pending request screen **1300** to select and approve a virtual desktop as well as approve a production, development, and test system **128** (i.e., a "destination") and select an access credential for that system. Starting from the left-hand side of

the virtual desktop request section **1302**, for a given incident, information displayed may include the service area, ticket number, user or employee ID and name of the technical support person assigned, unit or department to which the technical support person belongs, user or employee ID of the incident manager who assigned the incident, and name of the thin client (TC) terminal being used by the technical support person. The ACC manager may then select a virtual desktop (VD) terminal (e.g., via a drop-down list) and indicate approval for the technical support person to use the virtual desktop terminal. Similar information may be displayed for the destination request section **1304** along with the destination being requested. The ACC manager may then select an access credential, such as a "Prod ID" (e.g., via a drop-down list), for the destination and indicate his/her approval for the technical support person to access the destination.

FIG. **14** illustrates an exemplary active sessions screen **1400** that may be presented to the ACC manager to inform him/her of currently pending incidence. For a given incident, the information displayed in this screen may be similar to the information displayed in the pending request screen **1300** (see FIG. **13**). In addition, the active sessions screen **1400** may further include an option for the ACC manager to revoke at any given time a technical support person's approval to access a virtual desktop terminal (indicated at **1402**) and/or a destination (indicated at **1404**) by marking the appropriate option. Once approval has been revoked, the technical support person may no longer have access to the revoked virtual desktop terminal and/or destination.

FIG. **15** illustrates an exemplary ACC logon screen **1500** that a technical support person may use to initially logon to the ACC application **620** from his/her thin client terminal **108**. From this screen, the technical support person may log on to the ACC application **620** by entering his/her user or employee ID and password. The ACC application **620** may then verify the technical support person by checking his/her user or employee ID and password against information in the authentication server **126** in the manner described previously.

Once the technical support person has been verified, the ACC application **620** may present him/her with a remote access screen **1600**, as shown in FIG. **16**, that allows the technical support person to connect to a virtual desktop terminal. In some embodiments, the remote access screen **1600** may be a Remote Desktop Connection screen provided by Microsoft's Remote Desktop application. Such a remote access screen **1600** may include a computer field **1602**, which may be a drop-down list, that displays the various virtual desktop terminals to which the technical support person has been approved. In some embodiments, the computer field **1602** may be prefilled with the name of a particular virtual desktop terminal, such as the first one in the list or the one selected by the ACC manager for the technical support person. The technical support person may then click on a Connect button to connect to that virtual desktop terminal, or he/she may override the prefilled selection by choosing another virtual desktop terminal from the list.

FIG. **1700** illustrates a virtual desktop logon screen **1700** that may be presented to the technical support person after a connection to the virtual desktop terminal has been established. The virtual desktop logon screen **1700** may allow the technical support person to log on to the virtual desktop terminal by entering his/her user or employee ID and password. Once the technical support person has successfully logged on to the virtual desktop terminal, he/she may access the ACC application **620**, for example, by entering the URL of the ACC application **620** into a Web browser on the virtual desktop terminal. In some embodiments, the technical support person may also be required to log back on to the ACC application **620** at this point. In other embodiments, a hyperlink or other navigation mechanism may be provided on the virtual desktop terminal that the technical support person may use to log back on to the ACC application **620**.

Having accessed the ACC application **620** from the virtual desktop terminal, the technical support person may now request a connection to one or more destinations via a destination request screen **1800**, as shown in FIG. **18**. The destination request screen **1800** may include destination field, which may be a drop-down list of available destinations that the technical support person may select, as well as a ticket number field, which may also be a drop-down list of available incident ticket numbers that the technical support person may select. Clicking on a Submit button sends the selections to the ACC application **620** where they may be forwarded to an ACC manager for approval. The

FIG. **19** illustrates an exemplary destination request status screen **1900** that may be provided to the virtual desktop terminal of the technical support person from the ACC application **620** to allow the technical support person to view the status of his/her pending requests. Such a destination request status screen **1900** may include, for a given incident, the ticket number of the incident, destination requested, status of the request (e.g., approved, pending, etc.), and user or employee ID of the ACC manager. The launch routine described previously (see FIG. **8**) may also be downloaded to the virtual desktop terminal at this time along with the destination request status screen **1900**. The destination request status screen **1900** may also include a launch button **1902** that may be disabled until the destination request has been approved. Once the destination request has been approved, the technical support person may click on the Launch button **1902** to execute the launch routine in order to call an appropriate remote access application **520** in the manner described previously. A field **1904** allows the technical support person to enter any additional command line parameters for the remote access application **520** prior to clicking on the Launch button **1902**. As mentioned above, however, it is possible in some embodiments to radically execute the launch routine as soon as approval by the ACC manager is granted (i.e., without any intervention by the technical support person.

FIG. **20** illustrates an exemplary active sessions screen **2000** that may be provided to the virtual desktop terminal of the technical support person to allow the technical support person to view the status of various incidents he/she is currently handling. The information displayed on the screen is similar to corresponding information displayed on previous screens and will not be described in detail here. In the example of FIG. **20**, an expansion icon (e.g., a "+" sign, etc.) may be displayed next to certain incidents to indicate that the technical support person has accessed one or more destinations in connection with that incident (see second row, ticket number "P2222222"). Clicking on the expansion icon for an incident allows the technical support person to see which destinations he/she has accessed for that incident. A check-in option (indicated at **2002**) allows the technical support person to relinquish (i.e., check in) his/her access to any virtual desktop terminals and/or destinations he/she may have been granted approval for a given incident. Selecting the check-in option **2002** for a given incident effectively closes that incident and updates the ACC application **620** accordingly.

As mentioned earlier, the auto configuration module **708** may function to automatically provide new or updated configuration files on-the-fly to the root privilege manager **622**. Turning now to FIG. **21**, general guidelines are shown in the form of a method that may be used to implement the auto

configuration module **708**. As can be seen in FIG. **21**, an exemplary method **2100** for automatically providing new or updated configuration files on-the-fly may begin at block **2102**, where a value (e.g., the name, network address, etc.) representing the particular virtual desktop **124** that has been approved by an ACC manager for a technical support person to use may be retrieved from the ACC database **120**. At block **2104**, similar values representing the particular destination, or production, development, and/or test systems **128**, and the user ID (or production ID) that the ACC manager has approved for the technical support person to use may be likewise retrieved from the ACC database **120**. These retrievals may be performed by the auto configuration module **708** in real time as approval is granted, or they may occur according to some predefined schedule (e.g., every minute, five minutes, etc.) in a manner know to those having ordinary skill in the art.

At block **2106**, predefined variables in a configuration template may then be set to the values representing the destination and user ID approved by the ACC manager for the approved virtual desktop **124**. In some embodiments, predefined variables may also be set to values representing the commands that are permitted and programs that may be run on the destination and/or under the user ID. These commands and programs, like the destination and user ID, may be manually approved by the ACC manager, or they may instead be automatically retrieved from the ACC database **120** based on the particular user ID and/or destination selected, the nature and type of incident to be resolved, and/or the experience and expertise of the technical support personnel assigned to the incident.

Finally, at block **2108**, the configuration template may be saved as the configuration file for the jump server **130** on the ACC server **118**, for example, by assigning it the same name as the configuration file associated with the root privilege manager **622** (see FIG. **6**), which effectively overwrites the previously existing configuration file. Where the configuration file associated with the root privilege manager **622** is set up to reference multiple configuration files, the configuration template may be saved using the specific names of the other configuration files. In some embodiments, an optional block **2110** may also be present to zero out any configuration files that are no longer needed (e.g., after the connection to the jump server **130** is closed or terminated) in order to prevent their use.

An example of a configuration template that may be used with the disclosed embodiments is provided below as Example 1. Note that while the configuration template in Example 1 is for a PowerBroker configuration file, those having ordinary skill in the art will understand that configuration templates for other products may also be used without departing from the scope of the disclosed embodiments. Indeed, even different and/or multiple configuration templates may be used with the PowerBroker configuration file in some embodiments.

```
#pb.conf.acc.0001
# ACC PowerBroker Template
# Version 1.1
print("using pb.conf.acc.....");
jumpservers={"prodaccjs11*", "prodaccjs21*"};
# App will replace these values from database table -
targetservers={"HOSTVALUE", "HOSTVALUE.company.com"};
#
# e.g. was,mqm (HARD-CODED)
targetusers={"ab00000", "ae00000", "bk00000", "dw00000", "ei00000",
"id00000", "infaprod", "ir00000", "md00000", "nh00000", "ny00000",
"ob00000", "pc00000", "qn00000", "qz00000", "uk00000", "vb00000",
"vo00000", "yb00000"};
#
# App will replace these values with the appropriate PRODID from
database table - submitusers={"PRODID"};
#
if (command == "su") {
 if (argv[1] == "-") {
  if (argv[2] in targetusers) {
   if (runhost in targetservers) {
    if (submithost in jumpservers) {
     if (user in submitusers) {
      iolog=mktemp("/var/adm/pblogs/" + host + "-" + user +
      ".acc.XXXXXX");
      runuser = "root";
      rungroup = "!g!";
      rungroups = {"!G!"};
      setenv("PATH","/bin");
      accept;
     }
    }
   }
  }
 }
}
```

Example 1

An exemplary illustration of how the above configuration template may be used according to the disclosed embodiments is shown in FIG. **22**. As can be seen, the exemplary root privilege manager **622** in this example has a master configuration file **2200** (e.g., "pb.conf") associated therewith that contains a reference to one or more virtual desktop configuration files **2202**. The master configuration file **2200** depicted here includes a reference to one virtual desktop configuration file **2202** for each virtual desktop **124** (e.g., "Virtual Desktop 1.conf," "Virtual Desktop 2.conf," etc.), along with their locations (not expressly specified) in the file system of the root privilege manager **622**. Because the master configuration file **2200** does actually contain configuration information, it typically does not need to be changed unless virtual desktops **124** are to be added to or removed from the master configuration file **2200**. Each virtual desktop configuration file **2202**, on the other hand, may contain specific configuration information especially for its respective virtual desktop **124**. When a request is made by a technical support person from a virtual desktop **124** (i.e., after the launch routine (see FIG. **8**) has opened a remote session), the jump server **130** may refer to the configuration information in the configuration file **2202** for that particular virtual desktop **124** to grant or deny the request.

In accordance with the disclosed embodiments, when a different user ID, destination, and/or command set is approved for use with a virtual desktop **124** (e.g., Virtual Desktop 1), the auto configuration module **708** may retrieve the new configuration information from the ACC database **120**, fill in a configuration template **2204** with the new information, then save the completed configuration template **2204** as the configuration file for that virtual desktop **124** (e.g., "Virtual Desktop 1.conf"). This is illustrated by the dashed lines shown in FIG. **22**. Such an arrangement allows the configuration information in the virtual desktop configuration file **2202** to be automatically updated on-the-fly as approval is changed by the ACC manager to a different user ID, destination, command set, and the like.

While the disclosed embodiments have been described with reference to one or more particular implementations, those skilled in the art will recognize that many changes may

be made thereto. Therefore, each of the foregoing embodiments and obvious variations thereof is contemplated as falling within the spirit and scope of the disclosed embodiments, which are set forth in the following claims.

What is claimed is:

1. A system of controlling access by technical support personnel to a company's computing system, the system comprising a memory storing instructions, said memory coupled to a processor executing said instructions to:

receive identification information from the technical support personnel, the technical support personnel being physically and logically isolated from the company's computing system;

authorize the technical support personnel to request a first approval;

obtain the first approval for the technical support personnel, the first approval authorizing the technical support personnel to request a second approval;

obtain the second approval for the technical support personnel, the second approval authorizing the technical support personnel to access the company's computing system including a number of virtual desktops, wherein one of the number of virtual desktops is assigned to the technical support personnel operating a thin client terminal, based on a type of incident assigned to the technical support personnel and wherein the thin client terminal contains only specific remote access applications based on the type of incident assigned;

send user credentials through the thin client terminal displaying the one of the number of virtual desktops to access corresponding systems of the company's computing system via the one of the number of virtual desktops, wherein the user credentials are sent through the background of the thin client terminal displaying the one of the number of virtual desktops and wherein the user credentials are utilized to access a number of features of the company's computing system; and

automatically update configuration information for controlling access to the company's computing system based on the first and second approvals.

2. The system of claim **1**, wherein configuration information includes access credentials for the company's computing system.

3. The system of claim **2**, wherein one or more of the access credentials are manually selected by an access control center manager.

4. The system of claim **3**, wherein at least one access credentials is automatically retrieved from a database based on the one or more access credentials manually selected by an access control center manager.

5. The system of claim **2**, wherein the configuration information is provided to a root privilege manager, the root privilege manager providing a central repository for the configuration information.

6. The system of claim **5**, wherein controlling access to the company's computing system is performed by a jump server, the jump server controlling the access to the company's computing system based on the configuration information.

7. The system of claim **5**, wherein the root privilege manager and the jump server are implemented.

8. A method of controlling access by technical support personnel to a company's computing system, the method comprising:

receiving identification information from the technical support personnel, the technical support personnel being physically and logically isolated from the company's computing system;

authorizing the technical support personnel to request a first approval;

obtaining the first approval for the technical support personnel, the first approval authorizing the technical support personnel to request a second approval;

obtaining the second approval for the technical support personnel, the second approval authorizing the technical support personnel to access the company's computing system including a number of virtual desktops, wherein one of the number of virtual desktops is assigned to the technical support personnel operating a thin client terminal, based on a type of incident assigned to the technical support personnel and wherein the thin client terminal contains only specific remote access applications based on the type of incident assigned;

sending user credentials through the thin client terminal displaying the one of the number of virtual desktops to access corresponding systems of the company's computing system via the one of the number of virtual desktops, wherein the user credentials are sent through the background of the thin client terminal displaying the one of the number of virtual desktops and wherein the user credentials are utilized to access a number of features of the company's computing system; and

automatically updating configuration information for controlling access to the company's computing system based on the first and second approvals.

9. The method of claim **8**, wherein configuration information includes access credentials for the company's computing system.

10. The method of claim **9**, wherein one or more of the access credentials are manually selected by an access control center manager.

11. The method of claim **10**, wherein at least one access credentials is automatically retrieved from a database based on the one or more access credentials manually selected by an access control center manager.

12. The method of claim **9**, wherein the configuration information is provided to a root privilege manager, the root privilege manager providing a central repository for the configuration information.

13. The method of claim **12**, wherein controlling access to the company's computing system is performed by a jump server, the jump server controlling the access to the company's computing system based on the configuration information.

14. The method of claim **12**, wherein the root privilege manager and the jump server are implemented.

15. A non-transitory computer-readable medium having computer-executable instructions for controlling access by technical support personnel to a company's computing system, the computer-executable instructions executable by a processor to:

receive identification information from the technical support personnel, the technical support personnel being physically and logically isolated from the company's computing system;

authorize the technical support personnel to request a first approval;

obtain the first approval for the technical support personnel, the first approval authorizing the technical support personnel to request a second approval;

obtain the second approval for the technical support personnel, the second approval authorizing the technical support personnel to access the company's computing system including a number of virtual desktops, wherein one of the number of virtual desktops is assigned to the

technical support personnel operating a thin client terminal, based on a type of incident assigned to the technical support personnel and wherein the thin client terminal contains specific remote access applications based on the type of incident assigned;

send user credentials through the thin client terminal displaying the one of the number of virtual desktops to access corresponding systems of the company's computing system via the one of the number of virtual desktops, wherein the user credentials are sent through the background of the thin client terminal displaying the one of the number of virtual desktops and wherein the user credentials are utilized to access a number of features of the company's computing system; and

automatically update configuration information for controlling access to the company's computing system based on the first and second approvals.

16. The computer-readable medium of claim **15**, wherein configuration information includes access credentials for the company's computing system.

17. The computer-readable medium of claim **16**, wherein one or more of the access credentials are manually selected by an access control center manager.

18. The computer-readable medium of claim **17**, wherein at least one access credentials is automatically retrieved from a database based on the one or more access credentials manually selected by an access control center manager.

19. The computer-readable medium of claim **16**, wherein the configuration information is provided to a root privilege manager, the root privilege manager providing a central repository for the configuration information.

20. The computer-readable medium of claim **19**, wherein controlling access to the company's computing system is performed by a jump server, the jump server controlling the access to the company's computing system based on the configuration information.

21. The computer-readable medium of claim **19**, wherein the root privilege manager and the jump server are implemented.

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